SportsTurf MANAGERS ASSOCIATION

Experts on the Field, Partners in the Game.

www.stma.org

SAFE
The Foundation for Safer Athletic Fields

Fall Athletic Field Maintenance Calendar for the Transition Zone: September - November

Timing for maintenance practices is dependent on weather and location. Cooler areas will need to end or perform certain maintenance practices earlier in the season versus warmer climates, which can continue maintenance practices later into the year.

Mowing

Recommended mowing heights:

	September	October	November
Bermudagrass	1-2 in (should not exceed 2 inches)	1-2 in (should not exceed 2 inches)	1-2 in (should not exceed 2 inches)
Hybrid bermudagrass	¾-1.5 in (should not exceed 2 inches)	¾-1.5 in (should not exceed 2 inches)	¾-1.5 in (should not exceed 2 inches)
Kentucky bluegrass	1.5-3 in Should not exceed 3.5 inches	1.5-3 in Should not exceed 3.5 inches	1.5-3 in Should not exceed 3.5 inches
Perennial ryegrass	1.5-3 in	1.5-3 in	1.5-3 in
Annual ryegrass	1-1.5 in Should not exceed 2.5 inches	1-1.5 in Should not exceed 2.5 inches	1-1.5 in Should not exceed 2.5 inches
Tall Fescue	2-3.5 in Should not exceed 5 inches	2-3.5 in Should not exceed 5 inches	2-3.5 in Should not exceed 5 inches

Bermudagrass goes dormant during low temperatures. As winter approaches, mowing height should be raised if fields are not being overseeded. Do not exceed a 2 inch cutting height.

1/3 Rule

A general rule when mowing any stand of turfgrass is to remove no more than 1/3 of the total leaf surface at one time.

Effects of removing more than 1/3 of leaf surface:

- Negatively affect photosynthetic production of food
- Deplete carbohydrate reserves in the plant roots
- Graying or browning of leaf tips
- Root growth restriction
- Weed encroachment
- Increased susceptibility to damage from insects, disease, drought and traffic
- Excess clippings

Photo courtesy of Jerad Minnick

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Frequency

Mow as often as needed.

Bermudagrass fields may only need to be mowed once per week as cooler temperatures arrive during the fall. Be sure to gradually raise the cutting heights on non-overseeded bermudagrass fields beginning in September in order to promote winter hardiness. Cooling temperatures and shorter day lengths cause growth to slow and depending on location and temperatures, non-overseeded bermudagrass fields may not need to be mowed in November.

Cool season athletic fields may need to be mowed 2-3 times per week during September and early October. Ideal temperatures make this an active growth period. As cooler temperatures become more frequent, generally at the end of October and into November, fields may not need to be mowed as often and may only require once a week. Maintaining a low height will increase the density of the turf and improve the wear tolerance of the field for fall sports.

Special considerations:

- Weather
  - o Rain – in the event of excessive rain, mowing should be avoided to prevent rutting and compaction.
  - o Extreme temperatures
    - Avoid mowing in the middle of the day if temperatures exceed 90 degrees Fahrenheit as this may cause damage to the turf. High daytime temperatures rarely continue into October and November.
    - Avoid mowing (and turf use in general) when there is early morning frost. Traffic on frosted turf ruptures leaf blades and the damage will likely be visible into the following spring.
    - Bermudagrass goes dormant with the first killing frost.

Direction

Change direction each time the field is mowed. This promotes upright growth and can reduce wear from equipment continually following the same pattern. Mowing the same direction creates 'grain' and the wavelike ridges affect the speed and direction of ball roll.

Clipping Collection

Clippings typically will not need to be collected if the turf is being mowed on a regular basis using the '1/3rd rule.' However, variables such as weather conditions, season of the year, soil fertility, moisture conditions, growth rate of the turfgrass, and the surface playing characteristics of the sport sometimes require clipping collection. Collect clippings if they are so long and excessive that they negatively impact turf playability and/or turf health (i.e. blocking sunlight, increasing disease activity under the piles, etc.).

Benefits of returning clippings:

- Research at Penn State University shows that over a 3 year period, Kentucky bluegrass clippings returned 46-59% nitrogen to the plant.
- Clippings contain nutrients that act as a fertilizer for the turf. Microbes in the soil hydrolyze the clippings into a solution that plants are capable of using.
- Clippings comprised of leaf blades break down rapidly and do not contribute to thatch when removing no more than 1/3 of the leaf blade and clippings do not clump.

Negative effects of excessive clippings:

- Smother grass
- Provide ideal environment for disease and insects

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Equipment

No matter what type of equipment is used to cut the turf, maintaining a sharp blade is the most important element to have a healthy, well groomed, aesthetically pleasing turf.

Reel Mowers

- Provide the best cut for turf mown under 2 inches
- Cut grass with a scissor or shearing action where there actually is slight metal to metal contact. Blade and bedknife sharpness is important.
- Can cause longer grass to lay over
- Safer option to bystanders in comparison to rotary mowers – blade revolves slower and debris is rarely projected
- Require careful maintenance to keep adjusted and sharp

Rotary Mowers

- Provide the best cut for turf mown over 2 inches
- Cut grass using impact. Speed of blade rotation combined with blade sharpness cut the turf. If blade is not sharp, fraying may occur.
- Blades revolve at high speed and may project objects from beneath the deck.

Flail Mowers

- Typically used on utility turf mown over 2 inches but improved models can be used on athletic fields.
- Cuts grass by series of spinning, levered blades in a self-contained deck. Since blades are free-spinning, they 'give' if they strike a solid object and chances of blade breaking and being discharged are negligible.
- Ideal to use in park-like settings where sticks and other debris might exist as bystander safety is enhanced by the blade and deck design.

Irrigation

Recommended amounts per week (minus any rainfall):

September	October	November
1-1.5 in/week	1-1.5 in/week	1-1.5 in/week

Irrigation should occur on an as needed basis. One or two irrigations per week are usually sufficient to maintain fields. Bermudagrass likely does not need 1-1.5 inches of water per week in October and November unless it is in a drought period.

Photo courtesy of Jerad Minnick

Rootzone

It is important to know the soil physical properties (water infiltration rate, compaction, soil texture, soil structure, infiltration, water holding capacity, and soil drainage) of your rootzone to establish a successful irrigation program. Native soil rootzones containing high amounts of clays and/or silt typically have high water holding capacity. Sand based rootzones have little water holding capacity and may percolate water very quickly. Soils that have good aggregation permit more rapid infiltration than a soil with poor structural properties. If a soil is compacted, aggregation is reduced or absent. Compaction at or near the soil surface can greatly reduce the rate of water infiltration.

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Frequency

Water should be applied on an as needed basis. The proper amount of water to apply at any one time is dependent on water holding capacity of the soil, grass species, soil texture, climatic condition (rainfall, humidity, temperature, and wind movement), exposure, intensity of use, drainage and amount of moisture present when irrigation is started. Most turfgrasses require between 1-1.5 inches of water per week during their active growing period to remain healthy and resilient. When natural precipitation is not present, irrigation is essential to maintain the health of turf and if appropriately managed, a soil surface that still provides desirable footing characteristics with reduced surface hardness. Irrigating supports active growth and helps maintain turf's green color. It is necessary for photosynthesis, plant and environmental cooling, and plant rigidity. Properly irrigated turf also helps decrease weed encroachment and tolerates insect and disease pressure.

Always water at the first sign of wilt. Wilt is characterized by folded or curled leaves, blue-green color, and visible footprints left after the walking on the surface. Wilted turf recovers quickly if it is taken care of immediately. Traffic should not be allowed on wilted areas or recently recovered wilted areas.

Amount

To establish a successful watering program, the depth of the rootzone must be known. Deep, infrequent irrigation that wets the entire rootzone (generally 4 inches in depth) leads to the healthiest turf.

Deep and infrequent

- Leads to the healthiest plants
- Promotes development of deep, strong root systems that can extract water from a large volume of soil

Light and frequent

- Leads to weak, unhealthy plants
- Promotes shallow root systems
- Turf can become susceptible to algae, moss, and disease
- Light and frequent is only acceptable when establishing grass from seed, sprigs or sod or forcing growth with nitrogen fertilizer. When establishing turf, because seedlings are very susceptible to drying out, the seedbed should not be allowed to dry. These areas require irrigation 2-4 times daily depending on weather conditions. The amount of water applied should only moisten the top 1.5-2 inches of the soil profile. Once germinated seedlings reach 2 inches in height, begin shifting the irrigation strategy to deep and infrequent watering and prepare to mow the turf as the soils are dried.

Handwatering

- Some areas may be prone to drying out more quickly than other areas and may need to be supplemented by handwatering to extend the interval between watering events.
- Areas that are exposed or excessively fertilized may need up to ¼ inch of water daily

Weather conditions also affect the amount of water needed to sustain a healthy turfgrass. If the weather is cool and rainy, fall irrigation will not be needed for bermudagrass. In hot, dry, windy, and sunny conditions, more frequent irrigation is needed to make up for water lost to evaporation and transpiration. Turfgrasses vary in total amount of water required for growth, plus the amount of water transpired from the plant and evaporated from both plant and soil surface. Warm season turfgrasses utilize water efficiently and lose about 6-7 mm of water per day. Cool season turfgrasses typically lose more than 10 mm of water per day to evapotranspiration. High air temperature, low relative humidity, wind, growth rate, aerial shoot density, leaf area and leaf position all influence the amount of water lost by a turfgrass plant.

Timing

Early morning is the best time to water your turf.

Early Morning

- Between 4:00 am and 9:00 am is the best time to water.
- Reduced water loss to evaporation due to lower temperatures, less sunlight, and lower wind velocity.

- Reduced disease potential by minimizing the duration of leaf wetness.
- Depending on water source, municipal water demand is lower.

Midday

- Not an efficient time to water because water lost to evaporation is at its greatest potential.
- Midday watering can be effective if the goal is to temporarily cool plant temperatures and reduce heat stress. Syringing is a very light application of water applied to the turf leaf surface that cools the turf so it can get through the hottest part of the day.

Evening/Night

- Irrigating should be avoided during these hours.
- Excessively wet plants in the evening can remain wet throughout the night and make a favorable environment for fungal diseases.

Consequences of Over Irrigating

Do not irrigate at a rate faster than the soil can absorb. Once the rootzone is wet, additional water simply runs off the surface, wasting a valuable resource and potentially moving nutrients and chemicals in the surface flow. What is considered excess water is dependent on soil properties: water infiltration rate, compaction, soil texture, soil structure, infiltration, water holding capacity, and soil drainage.

Over watering can lead to:

- Poor turf health
- Increased weed, disease and insect problems
- Open, sparse stand invaded by moss and algae
- Poor appearance
- Runoff and/or leaching of nutrients and pesticides
- Anaerobic soil conditions
- Standing water
- Compaction
- Surface ruts

Managers should avoid applying water in large volumes all at one time and watch that irrigation patterns are adequately dispersed.

Photo courtesy of Chad Price, CSFM

Consequences of Too Little Irrigation

- Poor turf health
- A gradually thinning turf leading to increased pest problems
- Shallow root system
- A hard playing surface that can impact player safety

Drought

If cool season athletic fields do not have access to irrigation or you are facing a water ban or restrictions, allow fields to go dormant. Dormant fields should be watered once every four weeks during a drought. Fields will recover from dormancy as long as traffic is very limited. On warm season athletic fields, bermudagrass uses water efficiently and thrives in hot temperatures. Even in extended drought, bermudagrass only requires one to two irrigations per week.

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Fertilizer

Recommended amount of nutrients per month for warm season grasses:

	September	October/November
Bermudagrass	0.5-1 lb. N / 1000 sq ft	Apply product high in potassium. Follow cool season fertility program for ryegrass overseeding.
Hybrid bermudagrass	0.5-1 lb. N / 1000 sq ft	Apply product high in potassium. Follow cool season fertility program for ryegrass overseeding.

High nitrogen applications to bermudagrass should be avoided during the fall. No more than 0.5-1 lb. N / 1000 square feet should be applied prior to September 15. For intensively trafficked bermudagrass fields and/or fields overseeded with ryegrass, apply low nitrogen levels of 0.25 to 0.5 lb. N / 1000 square feet every two weeks until bermudagrass has fully entered dormancy and/or ryegrass has germinated. Apply standard fall nitrogen levels to ryegrass overseedings after the bermudagrass has entered dormancy. Applying high levels of nitrogen to bermudagrass after September 15 can reduce winter survival and increase leaching and runoff potential nitrogen. Applying a product high in potassium at the end of October or November will likely improve low temperature hardiness of bermudagrass, especially if potassium levels are limited as determined by a soil test.

Recommended amount of nitrogen per month for cool season grasses:

	September	October/November
Kentucky bluegrass	1 lb. / 1000 sq ft	1 lb. / 1000 sq ft
Perennial ryegrass	1 lb. / 1000 sq ft	1 lb. / 1000 sq ft
Annual ryegrass	1 lb. / 1000 sq ft	1 lb. / 1000 sq ft
Tall Fescue	1 lb. / 1000 sq ft	1 lb. / 1000 sq ft

Fall is the best time to apply nitrogen fertilizer to cool season grasses because there is enhanced root growth and carbohydrate storage potential during this season. An application in late August or early September allows for nitrogen release and enhanced growth during fall sports when fields are heavily trafficked. Another application can be made in late October or anytime in November after fall sports are over and top growth has slowed. Avoid applying fertilizer to frozen soils as this can negatively impact water quality due to fertilizer runoff. However, nutrients applied at appropriate times late in the growing season will encourage root growth, food storage, and density of turf. A slow release water insoluble fertilizer application can be beneficial as its controlled nitrogen release characteristics and low-leaching potential sustain turf growth for the fall and promote spring green up the following year. A quick release water soluble fertilizer can also be applied to prepare your fields for spring green up.

Make sure to check with your local and state agencies for any restrictions on applying nutrients. For areas with restrictions on inputs or other management program constraints or objectives, there are organic and microbial products available in the marketplace. STMA encourages you to talk with vendors and practitioners for recommendations to fit your specific needs.

Soil and Tissue Testing

Soil tests should be conducted on a routine basis – every one (sand-based fields) to three (native soil fields) years is recommended. A soil test will analyze nutrient requirements, pH, phosphorus and potassium levels, and will provide the best guide to fertilization to maintain or achieve a healthy field.

Tissue tests are a great diagnostic tool in that they provide a snapshot of nutrients present in the plant at the time the sample was taken. However, their real value is realized if conducted simultaneously with a soil test since only the soil report can provide clues as to why a nutrient deficiency or toxicity is occurring.

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Photo courtesy of Jerad Minnick

Nutrients

The macronutrients required for turfgrass growth include nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S).

Nutrient effects on turfgrass growth and health:

- Nitrogen – Influences color, shoot growth, shoot density, root growth, rhizome and stolon growth, carbohydrate reserves, high temperature stress, cold tolerance, drought resistance, wear tolerance, thatch accumulation, disease susceptibility and recuperative potential.
- Phosphorus – Involved in transfer and storage of energy for metabolic processes in turf. Affects seedling development, maturation, root growth and seed production. Needed during establishment. Phosphorus has been eliminated in many fertilizers due to potential environmental concerns. Also, soil that already has adequate phosphorus, does not need any additional from a fertilizer application. This is one reason why soil tests are necessary.
- Potassium – Involved in photosynthesis; Important in the regulation of stomates and internal water management; Maintain turgor pressure in plants; Affect root growth, heat, cold and drought tolerance, wear tolerance, disease susceptibility, and environmental stress resistance
- Calcium – Aids in cell wall structure and new cell formation; Stimulates root and leaf development
- Magnesium – Involved in formation of proteins; Found in chlorophyll molecule; Improves P uptake from soil; Aids in plant respiration
- Sulfur – Involved with formation of proteins; Helps with turf growth, green color, shoot growth and density, root growth, carbohydrate reserves, and disease susceptibility

The micronutrients required for turfgrass growth include iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), boron (B), molybdenum (Mb), chlorine (Cl), nickel (Ni). Adequate amounts of micronutrients are usually present in the soil as long as pH is appropriate. Excess amounts of these nutrients are more commonly seen than deficiencies. Deficiencies are much more likely in sand-based soils than heavier textured native soils.

Lime

Lime should only be applied in accordance with what is recommended on soil test results. If recommended amounts exceed 50 pounds per 1000 square feet, apply in split applications. Proper liming is as important as fertilization. Properly managed soil pH regulates nutrient availability and creates a soil environment not only desirable for turf, but also for healthy soil microorganisms.

Rootzone

Nutrient holding capacity of a rootzone varies depending on soil texture. Heavy, fine textured soils hold more nutrients than light, sandy soils. A rootzone with low nutrient retention is often best managed with light and more frequent fertilization unless water insoluble fertilizers are applied. Use tissue and soil tests to determine the amounts and application frequency needed to maintain a healthy turf environment.

Products

Quick release products are water soluble and cause a turf response in a week or less. These products are generally inexpensive, but have increased leaching and leaf burn potential if used improperly. Application should always either be planned before a rain event or followed with irrigation to prevent turf burn.

Slow release products are water insoluble and provide a gradual, sustained turf response over a period of 3-10 weeks or more. These products are generally more expensive, but rarely burn leaf blades.

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Equipment

Rotary spreader

- The most rapid way to apply product as fertilizer is distributed in a wide pattern.
- Holes in the bottom of the hopper drop granules on to a rotating impeller that slings granules in a pattern wider than the spreader.
- Distribution is not uniform and is more concentrated in the middle of the pass.
- To achieve uniformity, on each pass, granules should reach the wheel path of the previous pass.
- Splitting the application in half and applying material in two directions can help eliminate striping.

Drop spreader

- A very precise way to apply product as fertilizer is distributed by only the width of the hopper.
- A row of holes across the full width of the bottom of the hopper releases granules.
- Distribution is uniform across the width of the spreader.
- To achieve uniformity across the entire area, run the tire just inside the track from the previous pass.
- Splitting the application in half and applying material in two directions can help eliminate striping.

Plant Growth Regulators (PGRs)

Recommended time for application:

	September	October	November
Warm Season Grasses	X (optional depending on overseeding)		
Cool Season Grasses	X		

As growth slows with decreased temperatures, plant growth regulators become unnecessary. If bermudagrass fields are being overseeded, a plant growth regulator application may be desirable to slow the growth of bermudagrass and improve chances for ryegrass growth.

For best results with PGRs, be conscious of the grass species it is labeled for, how the product affects the plant, how the product enters the plant, and if water is necessary following application. Never apply PGRs to grass that is under stress.

Benefits

- Seedhead suppression
- Suppression of vertical top growth of desirable turfgrasses. Lateral spread of growth is unaffected.
- Improved recuperative potential
- Management of Poa annua growth and development
- Improved color
- Increased density
- Reduction of clippings
- Enhanced establishment
- Deeper roots
- Larger food reserves
- Beneficial for conversion programs when transitioning from one type of grass to another during overseeding programs
- Shift of plant carbohydrates to crowns, stems and roots may increase rooting and tillering
- Rebound – when turf reaches the end of the time period that PGRs are active, there is a surge of growth. Although also considered a disadvantage, if timed appropriately, the rebound can help recovery from late season traffic. Document applications so you can time the rebound effect.

Photo courtesy of Chad Price, CSFM

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Types (listing of a product by STMA is intended for information purposes only and is not an endorsement of the product)

- Class A – Late Gibberellic Acid Synthesis Blocker
  - o Entry - Foliar
  - o Mode of Action - Prevents cell elongation, promotes lateral growth, provides short periods of growth suppression activity
  - o Products - trinexapac-ethyl

- Class B – Early Gibberellic Acid Synthesis Blocker
  - o Entry - Roots
  - o Mode of Action – Inhibits cell elongation, promotes lateral growth, generally provides longer periods of growth suppression compared to class A
  - o Products – paclobutrazol, flurprimidol

- Class C – Mitotic (Cell Division) Inhibitors
  - o Entry – Foliar or roots
  - o Mode of Action – Inhibits differentiation in meristematic regions, suppresses vegetative growth and seedhead development
  - o Products - mefluidide

- Class D – Herbicides
  - o Entry – Foliar or roots
  - o Mode of Action - Herbicides used at low rates can suppress growth or seedhead development, inhibit growth and development through interruption of amino acid synthesis or fatty acid biosynthesis
  - o Products – glyphosate, ethofumesate

- Class E – Plant Hormone Generator
  - o Entry - Foliar
  - o Mode of Action - Generates ethylene, a hormonal regulator inside the plant which causes seedhead suppression
  - o Products – ethephon

Disadvantages

- Phytotoxicity – most products cause discoloration to the turf. This is not permanent and in some cases may be hidden by nitrogen applications.
- Cost – products are expensive, but the benefits provided by PGRs may outweigh the costs.
- Rebound – when turf reaches the end of the time period that PGRs are active, there is a surge of growth. Document applications so you can time reapplication to avoid the rebound effect.

Cultivation

Recommended time for soil cultivation:

	September	October	November
Bermudagrass – Overseeded	X (aerate prior to overseeding)		
Bermudagrass – Not Overseeded			
Cool season grasses	X	X	X

Timing

Do not vertical mow, dethatch or aerate bermudagrass fields in the fall unless they are being overseeded. Doing so can cause injury to bermudagrass that will not allow plants to successfully recover before winter. Even for overseeding, consider timing and level of cultivation in terms of how bermudagrass survival might be negatively impacted.

On cool season grasses, soil cultivation should be done once a month when plants are actively growing. However, if playing schedules make that difficult, aerify at least once in the fall, before the season begins, after the last game or both. More frequent coring may be necessary in heavily trafficked and compacted areas. Do not aerate if the turf is under severe stress.

Benefits of Soil Cultivation

- Physical penetration of the soil improves air, water and nutrient movement within the rootzone.

- Corrects or alleviates soil compaction. This is especially important for high traffic areas such as goal mouths. It may be necessary to cultivate these areas 6-8 times per year.
- Improve water infiltration.
- Improve gaseous exchange between the soil and atmosphere.
- Reduces thatch.

Equipment

Hollow tine

- Aerator pulls soil core (3/8 – ¾ inches in diameter) from a 2-6 inch depth.
- Helps minimize thatch and improves water penetration
- This method should be done at least twice a year with high traffic areas receiving it 4-6 times per year. This is an effective practice when done with renovation and reseeding.
- Soil cores can be removed or reincorporated into the rootzone using a dragmat.

Photo courtesy of Chad Price, CSFM

Solid tine

- Solid tines penetrate through the rootzone with minimal surface disturbance
- Increases initial water infiltration rate
- Effective way to plant seed with minimal disturbance to grass and soil stability
- An ideal tool to utilize during periods of intensive field use, but it does not substitute for overall benefits of core aeration.

Shatter coring

- Solid tines aggressively penetrate the soil and fracture below ground compaction zones at a depth up to 6 inches
- Promotes deep rooting, assists in removal of standing water, increases initial water infiltration rate
- Effective for planting seed and improving soil properties with minimal disturbance to the surface and soil stability

Water jet coring

- Streams of pressurized water penetrate thatch and loosen soil to promote root growth
- Effective way to cultivate stressed turf in unfavorable weather conditions
- Promotes deep rooting, increases water infiltration rate
- Minimal disturbance to the surface; does not substitute for overall benefits of core aeration.

Slicing

- V-shaped knives mounted on disks attached to a slowly rotating steel shaft cut into the turf
- Blades sever stems of creeping grasses (i.e. bermudagrass and Kentucky bluegrass) and promote additional lateral growth
- Promotes deep rooting, helps remove standing water
- Effective alternative to aggressive cultivation during extreme temperatures but use does not substitute for overall benefits of core aeration

Vertical mowing

- Knives that cut into the turf are attached to a rapidly spinning horizontal shaft.
- Depending on height adjustment, can be used to relieve grain, dethatch or cultivate.

Spiking

- Similar to a vertical mower, only blades are pointed rather than broad and flat. Blades are attached to a slowly turning horizontal shaft.
- Stimulates shoot and root growth

Deep tine

- Tines penetrate the soil to a depth of 6-18 inches.
- If using hollow tines, holes can be back filled with a soil amendment to improve drainage

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

- Solid tines are beneficial when cultivating heavily compacted clay or gravelly soil
- Minimal disturbance to the surface with use of solid tines; core aeration results in significant surface disruption and a concentrated effort to manage the cores and/or topdress with new soil material
- Promotes deep rooting, helps remove standing water, aggressively fractures below ground compaction zones at 6-12 inch depths, increases initial water infiltration rate, creates deep aeration channels, and improves air, water, and nutrient movement through layered, poorly drain soils

Photo courtesy of Elizabeth Guertal, Ph.D.

Deep drill/drill and fill

- Drills penetrate the soil to a depth of 6-18 inches
- Deep channels loosen soil

Overseeding of Bermudagrass

Timing for seeding:

	September	October	November
Perennial ryegrass	X	X	
Annual ryegrass	X	X	
Intermediate ryegrass	X	X	

The best time to overseed is usually from September 1 to 15 across the transition zone during a period when bermudagrass growth is slowing and soil temperatures are optimal for ryegrass seed germination. Bermudagrass growth usually ends in mid fall and goes dormant after the first killing frost. It remains dormant until soil temperatures reach 60 degrees consistently the next spring. If fields are overseeded too early, actively growing bermudagrass will outcompete the ryegrass. If fields are overseeded too late, cold temperatures may prevent sufficient establishment.

Preplanting Procedures

Cultivation

Recommended time for soil cultivation:

	September	October	November
Bermudagrass - Overseeded	X		

For a smooth transition and uniformly overseeded field, ryegrass seeds must have good seed to soil contact. This can be achieved by dethatching, core cultivation, close mowing, collecting clippings, topdressing, sweeping, and dragging the bermudagrass field. However, aggressive cultivation and/or vertical mowing so late in the season can be very detrimental to bermudagrass survival. Conduct aggressive cultivation programs during active periods of growth whenever possible. Plant growth regulators can also be applied to slow the growth of bermudagrass before seeding.

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Seeding

Amount of seed recommended for application:

Perennial ryegrass	10-15 lb / 1000 sq ft
Annual ryegrass	10-20 lb / 1000 sq ft
Intermediate ryegrass	10-20 lb / 1000 sq ft

Seed Selection

Perennial ryegrass

- Quick establishment
- Inexpensive
- Wear tolerant
- Fine texture
- More heat, disease and cold tolerant than annual ryegrass
- Dark green color
- Competes with bermudagrass during spring greenup

Annual ryegrass

- Quick establishment
- Inexpensive seed cost
- Very high mowing requirement
- Limited wear tolerance
- Coarser texture than perennial
- Typically light green color
- Dies out naturally in early summer

Intermediate ryegrass

- This hybrid seeks to provide the rapid establishment rate of annual ryegrass with improved turf quality and wear characteristics of perennial
- Cost similar to perennial ryegrass
- Moderate to good wear tolerance
- Coarser texture than perennial
- Light green color typical but newer varieties are darker green
- Dies out naturally in early summer

Postplanting Procedures

Mowing

Recommended mowing heights:

	September	October	November
Perennial ryegrass		5/8 – 2.5 in	5/8 – 2.5 in
Annual ryegrass		5/8 – 2.5 in	5/8 – 2.5 in
Intermediate ryegrass		5/8 – 2.5 in	5/8 – 2.5 in

Minimize traffic on overseeded fields as much as possible while seeds are germinating. On intensively trafficked fields, it is often desirable to split the total seed level desired in 2-3 applications throughout the fall. During establishment, seedlings can begin to be mowed when they reach about 2 inches in height. Once the seedlings are established, fields can be mowed at the recommended height. Anticipate greater mowing frequency with annual and intermediate ryegrass varieties.

Irrigation

Recommended amounts per week (minus any rainfall):

	September	October	November
Perennial ryegrass		1-1.5 inches	1-1.5 inches
Annual ryegrass		1-1.5 inches	1-1.5 inches
Intermediate ryegrass		1-1.5 inches	1-1.5 inches

During seedling germination, fields should be irrigated lightly three to four times a day. Do not overirrigate. Irrigation should be just enough to keep the seedlings moist throughout the day. As seedlings establish, irrigation can gradually decrease until it is on an as needed basis.

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Fertilizer

Recommended amount of nitrogen per month:

	September	October	November
Perennial ryegrass	0.25-0.5 lb. N / 1000 sq ft	0.5-1 lb. N / 1000 sq ft	0.5-1 lb. N / 1000 sq ft
Annual ryegrass	0.25-0.5 lb. N / 1000 sq ft	0.5-1 lb. N / 1000 sq ft	0.5-1 lb. N / 1000 sq ft
Intermediate ryegrass	0.25-0.5 lb. N / 1000 sq ft	0.5-1 lb. N / 1000 sq ft	0.5-1 lb. N / 1000 sq ft

Overseeded fields can be fertilized with low levels of nitrogen every two weeks until bermudagrass has fully entered dormancy and/or ryegrass has germinated. Standard fall nitrogen levels can be applied after bermudagrass has entered dormancy for color, growth and recovery of ryegrasses.

Weeds

Recommended time to apply herbicides:

	September	October	November
Timing for control		X	X
Weeds most commonly controlled		Primarily postemergent control of winter annual and perennial broadleaf weeds	Primarily postemergent control of winter annual and perennial broadleaf weeds

Do not apply preemergent control for winter annuals if fields are being overseeded. Maintaining a healthy dense stand of bermudagrass prior to overseeding will help discourage weed competition.

Insects

Timing of insect damage and the grass species affected:

	September	October	November
Perennial ryegrass	Protect seedlings from fall armyworm	Protect seedlings from fall armyworm	
Annual ryegrass	Protect seedlings from fall armyworm	Protect seedlings from fall armyworm	
Intermediate ryegrass	Protect seedlings from fall armyworm	Protect seedlings from fall armyworm	

Diseases

Timing of disease occurrence:

	September	October	November
Perennial ryegrass		Pythium damping off	Pythium damping off
Annual ryegrass		Pythium damping off	Pythium damping off
Intermediate ryegrass		Pythium damping off	Pythium damping off

Overseeding Advantages

- Improved color and field playability
- Mature ryegrass roots can decrease divot size
- Removal of soil moisture (dormant bermudagrass does not use soil water and relies only on evaporation)
- Reduce winter annual weeds

Overseeding Disadvantages

- Seedlings remain weak throughout the fall until they become fully established
- Poor summer bermudagrass recovery, ryegrasses don't die out easily because they have become hardy

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

- If not transitioned properly, field playability and safety can be compromised because of clumpy ryegrass
- Labor intensive
- Cost in establishment, maintenance and removal
- Reduction in field use during establishment

Overseeding is not a required practice for bermudagrass fields. Dormant, brown bermudagrass is not dead and can still provide a quality playing surface if it is maintained properly up until dormancy. Once it goes dormant, the field can withstand traffic, as long as it is not excessive. Overseeding success is dependent on how bermudagrass is prepared for overseeding and the management provided as ryegrass seeds germinate and plants develop. As part of a seasonal management plan, consider how overseeding fits the sport and site's needs. If a bermudagrass field is only used for fall football, winter overseeding might not establish quickly enough to be justified for this use. However, for spring sports, winter overseeding of a heavily trafficked turf might be the best way to provide a safe, quality playing surface.

Seeding

Recommended months to apply seed, sprigs or sod to bermudagrass fields that are not overseeded or cool season turfgrass fields:

	September	October	November
Common bermudagrass			
Hybrid bermudagrass			
Kentucky bluegrass	X	X	
Perennial ryegrass	X	X	
Tall Fescue	X	X	

Sod of any of these species can be installed at any time as long as the soil is not frozen, but consider that sodding during warmer parts of the fall will better ensure root development and a stable playing surface.

Recommended seeding rates:

Kentucky bluegrass	2-3 lb. / 1000 sq ft
Perennial ryegrass	4-6 lb. / 1000 sq ft
Tall Fescue	5-8 lb. / 1000 sq ft

Timing

Bermudagrass seeding or sprigging is not recommended during the fall. Bermudagrass requires warm temperatures for proper establishment, and with cooler temperatures in the fall, growth slows and grass goes dormant after the first frost. Sod can be installed essentially any time of the year soil is not frozen. However, if the field is to be played upon the following spring, bermudagrass sod installations should occur by early to mid-fall at the latest, and many times it is desirable to install a ryegrass overseeded sod that will provide the desired stability for spring sports due to ryegrass rooting.

On cool season athletic fields, it is important to seed throughout the year to maintain turf density. Early fall is the best time to seed. This time period is ideal for cool season grass establishment because late summer temperatures are warm enough to encourage quick germination and the cool, moist autumn weather will promote dense growth. If fall sports conflict with the seeding schedule, managers will seed often and at higher than normal rates to keep a healthy and dense stand actively growing. University research has also shown that athlete's cleats assist in incorporating the seed into the soil.

Species and Mixtures

Always use certified seed when overseeding athletic fields. Certification ensures that the cultivar listed on the label is what is contained in the bag. The label also lists a test date. Seed should not be sold if the test date is more than 15 months past.

The species used for seeding depends on the current species on the field and the amount of play the field will be receiving within six weeks of seeding.

Kentucky bluegrass

- Fine texture
- Resilient due to rhizomatous growth
- Traffic should not be allowed on the field until it is fully established due to slow germination and

establishment rates.
- Once established, produces better wear tolerance and recovery.
- Drought tolerant
- If the field is made up of 100% Kentucky bluegrass, a blend of different cultivars should be used to maximize disease resistance and wear tolerance.
- Most fields are a mixture of Kentucky bluegrass (80-90%) and perennial ryegrass (10- 20%). The germination and recovery rate of perennial ryegrass aid in maintaining turf cover and density on these fields.

Perennial ryegrass
- Fine texture
- Quick establishment
- Good traffic and wear tolerance when combined with Kentucky bluegrass
- Poor cold tolerance
- Most fields are a mixture of Kentucky bluegrass (80-90%) and perennial ryegrass (10-20%). The germination and recovery rate of perennial ryegrass aid in maintaining turf cover and density on these fields.

Annual and intermediate ryegrass
- Used primarily for winter overseeding and/or soil stabilization
- Coarse to medium texture
- Quick germination and quick recovery potential
- Provides green color throughout fall, winter and spring
- Poor drought and heat tolerance. Usually dies with hot summer temperatures

Tall Fescue
- Fine to medium texture
- Good pest tolerance
- Most drought and heat tolerant of all the cool season grasses
- Poor tolerance to mowing heights less than 2 inches
- Good wear tolerance
- Good spring greening
- Poor cold tolerance
- Popular choice on low-input athletic fields as a monostand; when used on higher maintenance athletic fields, tall fescue should not be mixed with more than 10% of Kentucky bluegrass. Due to tall fescue's bunch type growth, Kentucky bluegrass is often added to help knit plants together and provide better recuperative potential.

Pest Control

Healthy, dense stands of turf are the best way to prevent disease, weed or insect infestations. Following proper cultural practices throughout the year, including fertilization, irrigation, mowing, seeding, and soil cultivation, can minimize and sometimes eliminate pest problems. The goal of turf management is to produce healthy turf while limiting reliance on pesticides. Many managers follow Integrated Pest Management (IPM) practices. This program does not completely eliminate pests, but maintains the population at a tolerable level. Pesticides are often a part of IPM programs, but they are selected and applied responsibly to avoid health risks to other living organisms than those targeted. It is important to routinely scout the fields and identify the pest problem in the early stages so a decision can be made whether its effects need to be controlled culturally or chemically. University research and efforts by turf managers and communities continue to evolve and support the trend towards sustainable turf management.

Make sure to check with your local and state agencies for any restrictions on applying pesticides. For areas with restrictions on inputs or other management program constraints or objectives, there are organic and microbial products available in the marketplace. STMA encourages you to talk with vendors and practitioners for recommendations to fit your specific needs.

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Weeds

Recommended time to apply herbicides in all turfgrasses:

	September	October	November
Timing for control	X	X	X
Weeds most commonly controlled	Preemergent and postemergent control for winter annual and perennial broadleaf weeds Postemergent crabgrass control Preemergent control of annual bluegrass (do not apply herbicide that controls annual bluegrass if turf is being overseeded with perennial ryegrass	Preemergent and postemergent control for winter annual and perennial broadleaf weeds Preemergent control of annual bluegrass (do not apply herbicide that controls annual bluegrass if turf is being overseeded with perennial ryegrass)	Preemergent and postemergent control for winter annual and perennial broadleaf weeds Preemergent control of annual bluegrass (do not apply herbicide that controls annual bluegrass if turf is being overseeded with perennial ryegrass)

The best defense against weeds is by increasing density and vigor of turfgrass to discourage weed competition. Weeds fill in voids in the turf. These voids can be avoided with proper selection and establishment of turf, adequate liming and fertilization per recommendations from soil tests, proper mowing heights and watering deeply and infrequently. If herbicides are necessary to control weeds, preemergent and postemergent products will control winter annual and perennial broadleaf weeds and grasses. Spot treating weeds may be a desirable method of control as opposed to broadcast applications. Never apply herbicides if the turf is stressed.

Common Fall Weeds

Grassy weeds

- Annual bluegrass
- Annual ryegrass
- Dallisgrass
- Nimblewill
- Orchardgrass
- Creeping bentgrass

Broadleaf weeds

- Chickweed
- Purple deadnettle
- Henbit
- Speedwell
- Lawn burweed
- Carolina geranium
- Mouse-ear chickweed
- Clover
- Virginia buttonweed
- Ground ivy
- Dandelion
- Broadleaf plantain
- Buckhorn plantain
- Curly dock
- Cinquefoil
- Buckhorn plantain
- Broadleaf plantain
- Red sorrel
- Thistle
- Wild violet
- Wild carrot
- Black medic
- Buttercup
- Dog fennel
- Hawkweed
- Heal-all
- Sheep sorrel
- Shepherd's purse
- Yellow woodsorrel

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Insects

Timing of insect damage and the grass species affected:

	September	October	November
Bermudagrass and Hybrid Bermudagrass	White grubs, armyworm, cutworm, sod webworm)	White grubs, sod webworm	
Kentucky bluegrass	White grub, armyworm, cutworm, sod webworm	White grub, armyworm, cutworm	
Perennial, annual, and intermediate ryegrasses	Armyworm, cutworm	Armyworm, cutworm	
Tall Fescue	White grubs, armyworm, cutworm	White grubs, armyworm, cutworm	

Thin, weak turf is more susceptible to insect infestations. Insect damage can be minimized with proper selection and establishment of turf, adequate liming and fertilization per recommendations from soil tests, proper mowing heights and watering deeply and infrequently.

Diseases

Timing of disease occurrence and grass species affected:

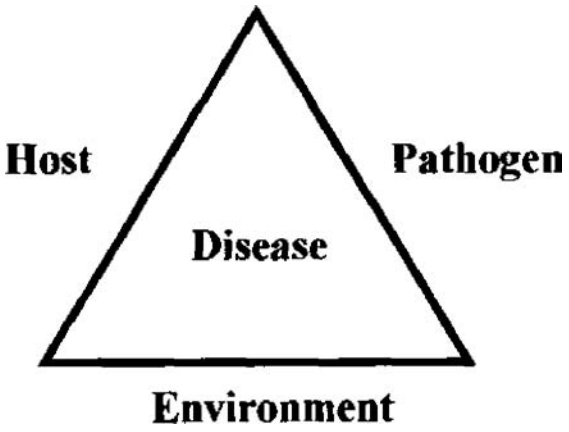
	September	October	November
Bermudagrass and Hybrid Bermudagrass	Brown patch, dollar spot, fairy ring, leaf spot/melting out, spring dead spot	Fairy ring, leaf spot/melting out, spring dead spot	Spring dead spot
Kentucky bluegrass	Leaf spot/melting out, red thread, dollar spot, necrotic ring spot, brown patch, leaf rust, powdery mildew, fairy ring, pythium blight	Leaf spot/melting out, dollar spot, powdery mildew, fairy ring	Gray snow mold, pink snow mold
Perennial, annual, and intermediate ryegrasses	Leaf spot/melting out, red thread, dollar spot, leaf rust, gray leaf spot, brown patch, fairy ring, pythium blight	Leaf spot/melting out, dollar spot, gray leaf spot, fairy ring	Gray snow mold, pink snow mold
Tall Fescue	Leaf spot/melting out, red thread, dollar spot, gray leaf spot, brown patch, fairy ring, pythium blight	Leaf spot/melting out, dollar spot, gray leaf spot, fairy ring	Gray snow mold, pink snow mold

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Disease Triangle

Diseases occur when three factors are present and meet the correct conditions.

1) A susceptible host – The grass plants are the hosts; choose resistant and/or tolerant varieties whenever possible.
2) A virulent pathogen – The disease-inciting organism is almost always present in the soil and not causing problems. However, conditions sometimes change and it can attack the turf.
3) A suitable environment – When certain environmental conditions are present, disease may occur. For example, hot, humid weather often contributes to the appearance of some diseases.



Symptoms and Preventative Measures

Leaf spot/melting out

- Symptoms – Small brown spots surrounded by a dark, purplish red border appear on the turf leaves. Spots enlarge until the entire width of the blade is blighted. When the crown becomes infected, entire tillers die and turf loses density.
- Prevention – Avoid excessive nitrogen in early spring. Use resistant turf cultivars. Water deeply and infrequently.

Red thread

- Symptoms – Circular or irregularly shaped patches of blighted grass have a reddish or pink color. The patch has a ragged appearance and leaves die from the tip downward. Pink, cottony mycelium are present in wet conditions.
- Prevention – Maintain fertility, but avoid excessive nitrogen. Water deeply and infrequently.

Dollar spot

- Symptoms – Spots appear small, circular, and sunken and can coalesce as disease progresses. Lesions on the leaves have an hourglass appearance with a bleached center with brown margins. In wet conditions, white, cottony mycelium can be present.
- Prevention – Maintain adequate nitrogen fertility. Water deeply and infrequently during morning hours. Promote air circulation.

Necrotic ring spot

- Symptoms – Circular patches of reddish brown or bronze leaves. As disease progresses, leaves turn a light straw color. Usually begins as a ring and as turf dies, a depression forms in the center.
- Prevention – Irrigate during periods of drought stress and increase mowing height. Maintain balanced fertility. Overseed with perennial ryegrass.

Brown patch

- Symptoms – Leaves have a dark margin with light brown in the center. Forms a circular patch that is surrounded by a dark purplish ring (known as a smoke ring) that is visible in the morning. White mycelium can be seen on affected areas.
- Prevention – Maintain adequate fertility and drainage. Remove dew in the morning and minimize thatch.

Photo courtesy of Dr. Noel Jackson

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Leaf rust

- Symptoms – Early infection appears as light yellow flecking of the leaves. As the disease progresses, reddish brown, powdery pustules appear.
- Prevention – Maintain balanced fertility and adequate irrigation. Mow regularly and minimize shade.

Powdery mildew

- Symptoms – White or gray mycelium that appears powdery or dusty appears on the leaves and sheaths. Severe infection leads to yellow, tan, or brown leaves.
- Prevention – Reduce shade and ensure there is air circulation. Maintain balanced fertility program. Avoid drought stress.

Fairy ring

- Symptoms – Darker green or faster growing grass appears in a circular or arc shape. There can sometimes be a circular area of dead grass within or outside the ring of lush growth. Mushrooms can also develop.
- Prevention – Control is very difficult. Maintaining core cultivation, irrigation and fertilization can help suppress the disease.

Pythium blight

- Symptoms – Wet leaves appear dark and water soaked and feel oily. As the leaves dry, areas are light brown or tan and are shriveled and matted. Affected areas are covered with fluffy white mass of mycelium. Disease tends to spread in patterns that follow water drainage.
- Prevention – Provide good drainage and avoid overwatering. Use slow release nitrogen products.

Gray snow mold

- Symptoms – Circular areas of turf turn yellow or gray/brown. Wet leaves become matted together and are covered with gray or while mycelium. Dry leaves are gray and brittle with no mycelium. A defining characteristic is the small, hard, round sclerotia on infected leaves. They can be white, pink, brown or black. Gray snow mold requires snow for development.
- Prevention – Avoid heavy applications of quick release nitrogen in late fall. Avoid excessive thatch and prevent compaction. Keep turf height low to prevent leaves from matting. Promote air circulation in early spring by removing snow and ensuring proper drainage

Pink snow mold

- Symptoms – Circular areas of turf turn tan, light gray, or orange-brown. Fluffy mycelium may be present that appears pink in sunlight. Snow does not need to be present for development.
- Prevention – Avoid heavy applications of quick release nitrogen in late fall. Keep turf height low to prevent leaves from matting.

Gray leaf spot

- Symptoms – First symptoms resemble drought and heat stress. Necrotic spots on the leaves are gray-brown with purple or brown borders surrounded by a yellow halo. Blades become blighted with a scorched or twisted appearance. Infected area can die within 3-5 days.
- Prevention – Maintain adequate irrigation and avoid watering at night. Promote good air circulation and drainage. Maintain balanced fertility program.

Photo courtesy of Purdue University

Spring dead spot

- Symptoms – Circular, completely dead patches of bermudagrass that are evident as the grass emerges from winter dormancy; soil-borne fungus attacks root systems and crowns during the fall and grass typically dies due to winter stress under its weakened condition
- Prevention – Sequential applications of appropriate fungicides in late summer to early fall can greatly reduce SDS pressure over 2-3 seasons; raise mowing heights in the fall, ensure appropriate pH and nutrient needs, reduce late-season N applications.

Chemical Control

Proper mowing, irrigation, fertilization, and cultivation can all lead to a healthy, dense field that is able to withstand moderate disease infestations. Unless fields have a history of poor disease tolerance, in order to abide by IPM standards, preventative fungicide applications are often not necessary. If the field is affected by a disease, a curative application should be sufficient.

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Calendar

General overview of necessary maintenance practices performed during the fall on cool season turfgrasses:

	September	October	November
Mowing	X	X	X
Irrigation	X	X	X
Fertilizer	X	X (one application in October or November)	
Plant Growth Regulators	X		
Cultivation	X	X	X
Seeding	X	X	
Weed Control	X	X	X
Insect Control	X	X	
Disease Control	X	X	X

General overview of necessary maintenance practices performed during the fall on warm season turfgrasses:

	September	October	November
Mowing	X	X	X
Irrigation	X	X	X
Fertilizer	X		X
Plant Growth Regulators	X (only if overseeding)		
Cultivation	X (only if overseeding)		
Seeding			
Weed Control	X	X	X
Insect Control	X	X	
Disease Control	X	X	X

Fall Athletic Field Maintenance Calendar for the Transition Zone: September – November

Calendar for Overseeded Fields (maintenance of perennial, annual, and intermediate ryegrasses)

	September	October	November
Seeding of perennial, annual, and intermediate ryegrasses	X	X	
Cultivation of bermudagrass	X		
Mowing		X	X
Irrigation		X	X
Fertilizer	X	X	X
Weed Control		X	X
Insect Control	X	X	
Disease Control		X	X