SportsTurf MANAGERS ASSOCIATION

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SAFE
The Foundation for Safer Athletic Fields

Annual Athletic Field Maintenance Calendar for Cool Season Turfgrasses

Proper maintenance practices are essential to maintain the health and safety of natural turfgrass athletic surfaces. The annual maintenance calendar provides guidelines and tips for each season to help you successfully manage turfgrass areas. Mowing, irrigation, fertilization, cultivation, seeding, and pest control are addressed as the primary practices to ensure optimal playing surface conditions.

Photo courtesy of Rich Watson

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Mowing

Turfgrasses generally need to be mown during the following months:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		X*	X	X	X	X	X	X	X	X*	X*

*weather dependent

Recommended mowing heights:

Cool Season Turfgrass Species	Height
Kentucky bluegrass	1.5-3 in Should not exceed 3.5 inches
Perennial ryegrass	1.5-3 in
Annual ryegrass	1-1.5 in Should not exceed 2.5 inches
Tall Fescue	2-3.5 in Should not exceed 5 inches

Mowing heights should be based on the turfgrass variety. Certain varieties can tolerate lower mowing heights compared to some common types that are unable to thrive at lower heights. 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. Removing more than 1/3 of the leaf surface can negatively affect photosynthetic production of food, deplete carbohydrate reserves in the plant roots, cause graying or browning of leaf tips, restrict root growth, encourage weeds, increase susceptibility to damage from pests, environment, and traffic, and contribute to excess clippings.

Frequency

Spring (March-May)

Mow as often as needed. During cooler temperatures in March and the beginning of April, fields may only need to be mowed once per week. Warmer temperatures throughout April and May will increase turf growth and the field may need to be mowed 2-3 times per week. Maintaining a low height will increase the density of the turf and improve wear tolerance of the field for spring sports.

Photo courtesy of Jerad Minnick

Summer (June-August)

Mow as often as needed – generally 2-3 times per week. Lower mowing heights maximize turf density when fertilizer and irrigation needs are met. This density is important for wear tolerance and withstanding weed, disease, and insect problems.

Fall (September – November)

Mow as often as needed. 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.

Winter (December – February)

In general, fields will not need to be mowed throughout the winter. Slowed growth from colder temperatures and potential snow cover can eliminate the need for mowing during these months. However, if warm temperatures continue into December, fields can be mowed as often as needed.

If you are using growth blankets on your turf, keep mowing heights under one inch. Warm temperatures and wet conditions during the winter months on turf over one inch can lead to disease problems.

Special Weather Considerations

Rain

In the event of excessive rain, mowing should be avoided to prevent rutting and compaction.

Extreme Temperatures

- Stay alert for frost. 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.
- If daytime temperatures exceed 90°F, avoid mowing in the middle of the day as turfgrass plants may be damaged. Turfgrass growth decreases with high temperatures; therefore, fields may only need to be mowed one per week during the summer months.

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.' 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. Clippings contain nutrients that act as fertilizer for the turf. Research shows that over a 3 year period, Kentucky bluegrass clippings returned 46-59% nitrogen to the plant. 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.).

Equipment

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

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. 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 cuts the turf. If blade is not sharp, fraying may occur.
- Blades revolve at high speed and may project objects from beneath the deck

Photo courtesy of James Brosnan, Ph.D. Photo taken by Paul Curtis.

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

When natural precipitation is not sufficient, 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. Proper irrigation also helps decrease weed encroachment and tolerance to insect and disease pressure by maintaining turfgrass health and vigor.

Turfgrasses generally need to be irrigated during the following months:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		X*	X	X	X	X	X	X	X	X*	

*weather dependent

Frequency and Amount

Water should be applied on an as needed basis. In general, cool season turfgrasses require 1-1.5 inches of water per week, minus any rainfall, during their active growing period to remain healthy and resilient. During hot, dry weather, turfgrass plants may need more water depending on the evapotranspiration rate. Always water at the first sign of wilt. Wilt is characterized by folded or curled leaves, blue-green color, and visible footprints left after walking on the surface. Wilted turf recovers quickly if it is watered immediately. Winter is not an active growth period for turfgrasses due to cold temperatures and snow cover. Therefore, turfgrass plants should be monitored and irrigation should occur on an as needed basis.

Photo courtesy of Jerad Minnick.

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 turfgrass plants. Plants develop deep, strong root systems that can extract water from a large volume of soil. 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.

Watering turfgrass areas lightly and frequently leads to weak, unhealthy plants, promotes a shallow root system, and increases probability for disease, algae, and moss development. Light and frequent is only acceptable when establishing grass from seed 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.

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 because there is reduced water loss to evaporation due to lower temperatures, less sunlight, and lower wind velocity. There is also reduced disease potential by minimizing the duration of leaf wetness. If using municipal water as a water source, water demand is lower in the early morning hours.
- Midday – Water lost to evapotranspiration is at its greatest potential at midday. Therefore, it is not an effective time to water. 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 create a favorable environment for fungal diseases.

Special Considerations when Irrigating

Rootzone

It is important to know the soil physical properties (water infiltration rate, compaction, soil texture, soil structure, infiltration/percolation, water holding capacity, and soil drainage) of your rootzone to establish a successful irrigation program. Native soil rootzones containing high amounts of clay 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, the rate of infiltration and/or percolation can be greatly reduced.

Photo courtesy of Jerad Minnick

Climatic Conditions

Weather conditions affect the amount of water needed to sustain healthy turfgrass. 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. Cool season turfgrasses typically lose more than 0.4 inches 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.

Drought

If 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.

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. Over watering can lead to poor turfgrass health, increased weed, disease, and insect problems, an open, sparse stand invaded by moss and/or algae, runoff and/or leaching of nutrients and pesticides, anaerobic soil conditions, standing water, compaction, and surface ruts. Managers should avoid applying water in large volumes all at one time and watch that irrigation patterns are adequately dispersed.

Consequences of Too Little Irrigation
If turfgrass plants cannot access enough water, it may lead to poor turf health, a gradually thinning turf, shallow root system, increased pest problems, and a hard playing surface.

Irrigation System

Irrigation Audit
It is important to know water output and uniformity of the irrigation system. This information can be obtained by hiring a certified irrigation auditor to inspect the irrigation system, or by conducting a simple irrigation audit yourself. Knowing the output in inches per hour can increase efficient water use and provide the correct amount of water to fields.

Winterizing the Irrigation System
The irrigation system should be winterized before or during the month of December. Otherwise, water present in the pipes may freeze and lead to many problems the following spring. If irrigation is necessary throughout the winter, the system can be charged with water and irrigation can take place. The system should be winterized again once the needed irrigation is completed.

Fertilization

Recommended amount of nitrogen per month:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		0.25-1 lb. soluble N / 1000 sq ft	0.25-1 lb. soluble N / 1000 sq ft	1.5 lb. insoluble N / 1000 sq ft	0-0.7 lb. / 1000 sq ft	0-0.7 lb. / 1000 sq ft	0-1 lb. / 1000 sq ft	1 lb. / 1000 sq ft	1 lb. / 1000 sq ft		1-2 lb. soluble N /1000 sq ft*

*dependent on fall sports schedule

Frequency

Nutrient applications on all sports fields should be based off of soil test recommendations.

Spring (March-May)

Fertilizer applications in March and April can aid in winter recovery and stimulate spring green up. Applications in May can help with recovery from spring sports damage. Excessive applications of nitrogen in the spring causes increased shoot and leaf growth and has little effect on root growth. Reduced root growth leads to weaker plants and reduced stress tolerance to summer temperatures. Plants are also more susceptible to disease, weed, and insect problems. Excessive top growth also requires more frequent mowing. Therefore, based on soil test recommendations, spring fertilizer applications should be limited and well planned to meet the nutrient needs of athletic fields.

Photo courtesy of Jim Brosnan, Ph.D.

Summer (June – August)

Unless the athletic field receives intensive use during the summer months, fertilization should be avoided during extreme weather because turf is not actively growing. High temperatures, humidity and drought cause stress to the plant, and summer fertilizer applications may cause a flush of growth that is detrimental. Growth occurs mainly in the shoots and depletes necessary carbohydrate reserves in the roots which can lead to a weak plant and shallow root system. The stressed plants have poor tolerance for traffic and disease, weed, and insect infestations. A flush of growth in the summer will also require an increase in mowing and irrigation which can further stress the plants.

Fields used intensively during June, July, and August may need minimal fertilization and supplemental irrigation to maintain turf vigor and increase recovery from damage. These light fertilizer applications are often referred to as spoon feeding.

Mid to late August is a common time to begin fall fertilization applications. Applying nutrients at this time allows for release during fall sports when fields are heavily trafficked.

Fall (September-November)

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.

Winter (December – February)

Soils with suitable pH levels and appropriate balances of nutrients promote winter hardiness of cool season grasses. However, when additional nutrients are needed, winter applications are often ineffective due to the low activity of the turfgrass root system. Beneficial responses of the nutrients can occur only if they are absorbed by the plant and not that they simply occur in the soil. Supplemental nutrient applications should be made during the optimal growing conditions of the fall.

If late season fertilization is necessary, it should only occur when shoot growth stops, grass is still green, and before the soil freezes. Application to frozen soils can negatively impact water quality due to runoff. Quick release water soluble nitrogen can be applied at 1-2 pounds per 1000 square feet to promote early spring green up the following year. If growth blankets are being used, monitor your turf areas closely when applying nitrogen. If a winter is wet and warm, excessive nitrogen can lead to disease problems.

Applications of potassium at this time are also beneficial to fields. Potassium will help in decreasing potential for winterkill.

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 amounts and frequency 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.

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.

Maintains turgor pressure in plants. Affects 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), and 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.

Late fall and early winter can be an ideal time to apply lime if it is needed to adjust soil pH. Lime should not be applied to frozen soil and/or turf. The desired soil chemical responses from lime applications often take weeks/months, so soil pH can be adjusted prior to the active growing season of the spring.

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. Slow release products normally require sufficient moisture, optimal temperatures (above 55° F) and/or microbial activity (or most often a combination of the three) to release the intended nutrient or active ingredient. The time of year in which these products are applied can be critical for their success. These products are generally more expensive, but rarely burn leaf blades.

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.

Equipment

Rotary spreader

- The most rapid way to apply product as fertilizer.
- 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.
- 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:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			X	X	X	X*	X*	X	X*		

*weather dependent

For best results with PGRs, be conscious of the grass species for which it is labeled, how the product affects the plant, how the product enters the plant, and if water is necessary following application. Never apply PGRs to turfgrass that is under stress or not actively growing.

Benefits of Plant Growth Regulators

- Suppression of vertical top growth of desirable turfgrasses. Lateral spread of growth is unaffected
- Improved recuperative potential
- Management of *Poa annua* growth and development
- *Poa annua* seedhead suppression
- Improved color
- Increased density
- Reduction of clippings
- Enhanced establishment
- Deeper roots
- Larger food reserves
- Beneficial for conversion programs when transitioning from one type of turfgrass 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 within the plant, there is a surge of growth. If timed appropriately, the rebound can help recovery from traffic. Document applications so you can time the rebound effect
- Potential cost savings in certain cases by reducing fuel, equipment, and labor costs over the course of a growing season.

Disadvantages of Plant Growth Regulators

- 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.

Types

Class A – Late Gibberellic Acid Synthesis Blocker
Class A PGRs prevent cell elongation, promote lateral growth, and provide short periods of growth suppression. Entry is foliar.

Class B – Early Gibberellic Acid Synthesis Blocker
Class B PGRs inhibit cell elongation, promote lateral growth, and generally provide longer periods of growth suppression compared to Class A. Entry is through the plant roots.

Class C – Mitotic (Cell Division) Inhibitors
Class C PGRs inhibit differentiation in meristematic regions and suppress vegetative growth and seedhead development. Entry is foliar or by plant roots.

Class D – Herbicides
Herbicides used at low rates can suppress growth or seedhead development and inhibit growth and development through interruption of amino acid synthesis or fatty acid biosynthesis. Entry is foliar or through plant roots.

Class E – Plant Hormone Generator
Class E PGRs generate ethylene, a hormonal regulator inside the plant which causes seedhead suppression. Entry is foliar.

Cultivation

Recommended time for soil cultivation:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		X*	X	X	X*	X*	X	X	X	X	X**

*weather dependent
**dependent on fall sports schedule and weather

Timing

Spring (March-May)

On cool season grasses, fields should be cultivated when turf is actively growing and the rootzone has dried from thawing and spring precipitation. Vertical mowing in early spring may aid in opening the canopy and help with spring green up. Fields should be hollow or solid tine cultivated at least once in the spring. Monthly or more frequent cultivation will benefit the turf, especially heavy traffic areas, as long as the fields are not under too much stress or temperatures are not consistently higher than 80°F. More aggressive types of cultivation should occur according to field needs.

Summer (June-August)

Aerating during hot, dry periods can cause extreme stress to plants and inhibit recovery. Grasses are in a semi dormant state during the summer and do not have the recovery potential of actively growing plants. Mid to late August is a common time for soil cultivation because summer temperatures are beginning to break and fields need to be prepared for fall sports traffic.

Fall (September-November)

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

Winter (December-February)

Cultivation on cool season turfgrass fields is most beneficial during periods of active turf growth in order to promote recovery and optimize playability of the field. October and November are the preferred months for cultivation. However, if fall sports schedules prevent the field from being cultivated prior to December, it should be cultivated immediately following the last game. Although recovery from cultivation this late in the season will be slower, it is beneficial to the long term health of the field.

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.
- Reduce thatch.

Photo courtesy of Chad Price, CSFM

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
- For best results, fields should be core cultivated twice a year with high traffic areas receiving it 4-6 times per year
- Effective practice when done with renovation and reseeding
- Soil cores can be removed or reincorporated into the rootzone using a dragmat

Solid tine

- Solid tines penetrate 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 belowground 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. Core aeration results in significant surface disruption and a concentrated effort to manage the cores and/or topdress with new soil material
- Solid tines are beneficial when cultivating heavily compacted clay or gravelly soil. There is minimal disturbance to the surface with use of solid tines
- Promotes deep rooting, helps remove standing water, aggressively fractures belowground 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
- Holes are backfilled with a soil amendment to improve internal drainage

Seeding

Recommended months to apply seed or sod:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
X*	X*	X	X	X			X**	X	X	X	X*

*weather dependent

**due to high summer temperatures, seeding should not take place before mid August

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

Recommended seeding rates (seed rates expressed in pounds of pure live seed):

Kentucky bluegrass	2-3 lb. / 1000 sq ft
Perennial ryegrass	4-10 lb. / 1000 sq ft
Annual ryegrass	4-10 lb. / 1000 sq ft
Tall fescue	5-8 lb. / 1000 sq ft

Timing

It is important to seed throughout the year to maintain turf density.

Spring (March-May)

Depending on the severity of winter weather, fields may need to be overseeded to repair bare areas. High traffic areas may require higher seeding rates to increase the likelihood of growth and establishment and withstand spring sports wear. Seeding rates of 10-20 lbs / 1000 square feet or more can help in the rapid recovery of bare spots on fields. Seeding following core cultivation is an effective practice to encourage germination and growth. If applying preemergence herbicides for spring weed control, be sure to read the label as some products can be detrimental to the growth of new seedlings.

Summer (June-August)

If a field cannot be regularly irrigated during the hot, dry summer months to encourage healthy germination, seeding should be avoided. The best time to seed is in mid August and continuing into the fall. Mid to late August is an ideal time for grass establishment because late summer temperatures are warm enough to encourage quick germination and the cool, moist autumn weather will promote dense growth.

Photo courtesy of Simon Gumbrill

Fall (September-November)

Early fall is the best time to seed. This time period is ideal for 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. Seeding rates of 10-20 lbs / 1000 square feet or more can aid in the rapid recovery of bare spots on fields. University research has also shown that athlete's cleats assist in incorporating the seed into the soil.

Winter (December-February)

Seed can be applied to dormant turf and/or following late season cultivation. Dormant seeding is when seed is applied to dormant turf or frozen soil and lies dormant until soil temperatures warm in April or May. Dormant seeding can take place beginning in November and continue as late as March. Growth covers can be used to assist in seedling germination and enhance development during the winter. These breathable covers protect seedlings from frost and freeze damage. Turf managers must monitor beneath the blankets for growth and pest problems due to increased temperature and moisture. Dormant seeding is beneficial because as the soil heaves and cracks during the winter, crevices are created for the seeds. This creates ideal germination conditions as temperatures begin to warm. The seed can also succumb to many fates while sitting on the surface for months waiting to grow. Disadvantages associated with dormant seeding include seed rot, seed desiccation, or runoff due to water.

Species and Mixtures

Always use certified (blue tag) 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 overseeding 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
- Slow germination and establishment rates
- Mature plants produce better wear tolerance and recovery
- Drought tolerant

Perennial ryegrass

- Fine texture
- Quick establishment
- Good traffic and wear tolerance when combined with Kentucky bluegrass
- Poor cold tolerance

Annual ryegrass

- Coarse to medium texture
- Quick germination and recovery potential
- Poor drought and heat tolerance
- Cold tolerant – used primarily for winter overseeding and/or soil stabilization

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

Combinations

- If a 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.
- 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.

Photo courtesy of Mike Fidanza, Ph.D.

Weeds

Recommended time to apply herbicides:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Pre-G Pre-BL	Pre-G Post-G Pre-BL Post-BL	Pre-G Post-G Pre-BL Post-BL	Pre-G Post-G*	Post-G Post-BL**	Post-BL***	Post-BL	Post-BL	Post-BL	

Pre-G – Preemergence control of grassy weeds
Pre-BL – Preemergence control of broadleaf weeds
Post-G – Postemergence control of grassy weeds
Post-BL – Postemergence control of broadleaf weeds
*dependent on weather and geographic location, apply in early June
**spot treatments only
***apply in late August

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.

Spring (March-May)

Preemergence and postemergence herbicides may be used to control winter annual, summer annual, and perennial broadleaf weeds and grasses. Crabgrass is commonly controlled in the spring. If using preemergence control for crabgrass, forsythia and dogwood bloom provides an indicator for application timing. Spot treating weeds may be a desirable method of control as opposed to broadcast applications.

Always read the label when applying preemergence herbicides, as some can be detrimental to the growth of new turfgrass seedlings. If using postemergence herbicides, weeds should be actively growing for the most effective control. Never apply herbicides if the turf is stressed.

Summer (June-August)
A product that provides postemergence control will be the most effective during summer months as weeds have already germinated. Herbicides should only be applied when turf is actively growing, temperatures are less than 85 degrees Fahrenheit, and soil moisture is adequate. Spot treating weeds may be a desirable method of control as opposed to broadcast applications. Midsummer applications during a drought or high stress periods should be avoided as they can be detrimental to the turf.

Fall (September-November)
If herbicides are necessary to control weeds, a product that provides postemergence control will be the most effective. Herbicides should only be applied when turf is actively growing, temperatures are less than 85 degrees Fahrenheit, and soil moisture is adequate. Spot treating weeds may be a desirable method of control as opposed to broadcast applications.

Winter (December-February)
In order to abide by IPM standards, herbicide applications are uncommon during the winter. Some turf managers may take this opportunity to eliminate winter annuals and perennial broadleaves with a postemergence product.

Insects

Recommended time to control insects:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		X	X	X	X	X	X	X	X		

Timing of insect damage and the grass species affected:

	Spring (March-May)	Summer (June-August)	Fall (September-November)	Winter (December-February)
Kentucky bluegrass	Black turfgrass ataenius (adult) Bluegrass billbug (adult) Bronzed cutworm Chinch bug (adult) Sod webworm White grub	Bluegrass billbug Chinch bug Sod webworm White grub	Armyworm Cutworm Sod webworm White grub	
Perennial ryegrass	Black turfgrass ataenius (adult) Bluegrass billbug (adult) Bronzed cutworm Chinch bug (adult) Sod webworm White grub	Chinch bug Sod webworm White grub	Armyworm Cutworm	

Annual ryegrass	Black turfgrass ataenius (adult) Bluegrass billbug (adult) Bronzed cutworm Chinch bug (adult) Sod webworm White grub	Chinch bug Sod webworm White grub	Armyworm Cutworm	
Tall Fescue	White grub	Sod webworm White grub	Armyworm Cutworm White grub	

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.

Insect damage rarely occurs in the winter and spring, but turf managers should always monitor for populations and treat accordingly. Many insects are in their adult stage during the spring. If fields have a history of insect damage, spring may be an optimal time for control of adult populations. Otherwise, insecticides may not be necessary.

Diseases

Recommended time to control diseases:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
X*	X*	X	X	X	X	X	X	X	X	X*	X*

*weather dependent

Timing of disease occurrence and grass species affected:

	Spring (March-May)	Summer (June-August)	Fall (September-November)	Winter (December-February)
Kentucky bluegrass	Damping-off/seed rot Dollar spot Fairy ring Gray snow mold Leaf rust Leaf Spot/Melting out Necrotic ring spot/ summer patch Pink snow mold Powdery mildew Red thread Yellow patch	Brown patch Dollar spot Fairy ring Leaf rust Leaf spot/melting out Necrotic ring spot/ summer patch Powdery mildew Pythium blight Red thread	Brown patch Dollar spot Fairy ring Gray snow mold Leaf rust Leaf spot/melting out Leaf rust Necrotic ring spot/ summer patch Pink snow mold Powdery mildew Pythium blight Red thread	Gray snow mold Pink snow mold

Perennial ryegrass	Damping-off/seed rot Dollar spot Fairy ring Gray snow mold Leaf rust Leaf Spot/Melting out Pink snow mold Red thread	Brown patch Dollar spot Fairy ring Gray leaf spot Leaf rust Leaf spot/melting out Pythium blight Red thread	Brown patch Dollar spot Fairy ring Gray leaf spot Gray snow mold Leaf rust Leaf spot/melting out Pink snow mold Pythium blight Red thread	Gray snow mold Pink snow mold
Annual ryegrass	Damping-off/seed rot Dollar spot Fairy ring Gray snow mold Leaf Spot/Melting out Pink snow mold Red thread	Brown patch Dollar spot Fairy ring Gray leaf spot Leaf rust Leaf spot/melting out Pythium blight Red thread	Brown patch Dollar spot Fairy ring Gray leaf spot Gray snow mold Leaf spot/melting out Pink snow mold Pythium blight Red thread	Gray snow mold Pink snow mold
Tall fescue	Damping-off/seed rot Dollar spot Fairy ring Gray snow mold Leaf Spot/Melting out Pink snow mold Red thread Yellow patch	Brown patch Dollar spot Fairy ring Gray leaf spot Leaf spot/melting out Powdery mildew Pythium blight Red thread	Brown patch Dollar spot Fairy ring Gray leaf spot Gray snow mold Leaf spot/melting out Pink snow mold Pythium blight Red thread	Gray snow mold Pink snow mold

Disease Triangle

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

- A susceptible host – The grass plants are the hosts; choose resistant and/or tolerant varieties whenever possible.
- 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 turfgrass plants.
- 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.

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.

If turf blankets are being used, carefully monitor the area for disease. Warm, wet weather during the winter can increase the likelihood for disease appearance. Fungicide applications may be necessary depending on winter weather.

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.

Annual Cool Season Maintenance Calendar Overview

Timing suggestions for maintenance practices performed on cool season turfgrasses:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mowing			X*	X	X	X	X	X	X	X	X*	X*
Irrigation			X*	X	X	X	X	X	X	X	X*	
Fertilization			X	X	X	X†	X†	X	X	X††		X^
Plant Growth Regulators				X	X	X	X†	X†	X	X†		
Cultivation			X*	X	X	X†	X†	X	X	X	X	X*^
Seeding	X*	X*	X	X	X			X (after Aug 15)	X	X	X	X*
Weed Control			X	X	X	X (early June)	X (spot treat only)	X (late Aug)	X	X	X	
Insect Control			X	X	X	X	X	X	X	X		
Disease Control	X*	X*	X	X	X	X	X	X	X	X	X*	X*

* weather dependent
† optional
†† one application in Oct or Nov
^ dependent upon fall sports schedules