Management of Natural Turf Sports Fields

Bulletin E354





Cooperative Extension

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Key Points

- Maintaining a dense turf cover with enough vigor to outgrow damage from play should be the primary focus of a sports field management program.
- Damage from overuse of natural turf fields is a common challenge. Programs to control traffic (permitting of field use and rotating and closing of fields) are needed to prevent severe loss of natural turf from year-long, unregulated play.
- Soil cultivation (aerification) and overseeding practices in addition to mowing, fertilization, and irrigation are essential to the health and vigor of natural turf sports fields receiving intense play.
- Partitioning school and municipal grounds into management zones with specific pest thresholds is an effective Integrated Pest Management (IPM) technique to minimize pesticide use and identify areas where pesticides may not be needed.

An attractive natural turf sports field appeals to spectators and enhances community pride. Of greater importance, however, is the stable, resilient turf surface that provides the footing needed for athletic play and the cushion to protect athletes against injury. Overused sports fields often lose turf cover and degrade to a bare soil surface within the high play zones of fields. Bare soil on a sports field becomes very hard and dusty when dry, and muddy and slippery when wet.

Properly managed natural turf can withstand a significant amount of play without wearing out and losing its turf cover. Abuse, however, can cause permanent damage that cannot be overcome by even the best maintenance program. For example, the use of fields when the turf and soil are extremely wet is likely to result in severe damage that will require costly procedures to repair. Field conditions will steadily degrade if the repair is not properly timed or not performed at all.

Maintaining a dense cover of turfgrass with vigorous growth is essential to producing high-quality playing surfaces on intensively used sports fields. Unfortunately, there is not an exact answer to the question of how many events a sports field can tolerate per year. This question is difficult to answer because of the numerous factors that affect the ability of natural turf to tolerate traffic including the sport, age of athletes, season, duration of play, wetness during play, soil type, construction design, variety of turfgrass, weather during recovery, and regime of maintenance practices.

This bulletin describes the concepts employed in the proper management of natural turf sports fields.

Control Traffic/Play

A traffic control program should regulate field use and allow field maintenance programs to keep pace with damage from play. One common approach is the designation of game and practice fields. Game fields are

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obviously the most important fields and are provided the most protection and greatest use restrictions compared to practice fields. Accordingly, practice fields may actually have the greatest need for maintenance inputs and repair.

Field use permitting is another approach to control traffic to sustainable levels. Develop a use permit system that only allows fields to be used a specific number of times at a specific time(s) of the year. Schedule time for routine maintenance as well as rest periods to allow the field to reestablish turf cover and density by way of recovery or repair efforts. Field use permitting also provides a structure to collect user fees for those situations where it is appropriate/necessary.

Signage, fencing, and flagging are very useful for educating and alerting users that fields are either open or closed to play. The most effective signs are easy to understand yet informative to users. Informed users are more likely to abide with field use restrictions if they understand the program. Signs should inform users about why fields are closed and what to expect when fields re-open. Fencing and flagging can be used to reinforce signage that fields are open or closed. If feasible, establish at least one alternate field that is always open to users when other fields are periodically closed. Not unexpectedly, "always open" fields will not have ideal conditions but it provides users an option when the higher priority fields are closed.

In communities where the demand for sports fields is great, many grounds managers have found that installation of a synthetic turf field helps to manage traffic on natural turf sports fields. Synthetic fields are durable over a wide range of weather conditions and better withstand intense, prolonged use scheduling over a short time span. Natural turf fields can be protected by scheduling sporting events that require frequent day and night (lighted fields) play onto a synthetic field. This type of field rotation is especially helpful during early spring and late fall when natural turf fields have low vigor (growth) during cold weather. Synthetic turf fields have high installation costs and require routine maintenance during their lifespan. Long-term budgeting needs to include costs for removal, disposal (or perhaps recycling) and surface replacement of worn out synthetic surfaces. Recognize that some community members may be opposed to development of synthetic fields as replacement of, or supplement to, a more natural landscape.



Unregulated access/traffic to a recreational area that has destroyed the turf cover.



Signage, fencing and flagging system that is a highly effective method of controlling field activity and preventing unsustainable use/traffic.



Periodic assessment of soil conditions with profiling tools is effective at identifying hidden problems.

Maintenance Practices

Investments in the establishment, renovation, or reconstruction of sports fields can be wasted unless an appropriate maintenance program is implemented. A sound maintenance program requires a well-thought out budget to properly allocate materials, equipment, and personnel as well as a conscientious and knowledgeable grounds manager being available to implement and oversee the program. In cases where natural turf maintenance tasks are outsourced to contractors, the owner (school district, town, etc.) should retain at least one employee with a thorough knowledge of sports field management to authorize appropriate bid specifications and provide oversight of contractor performance.

The primary goal of a maintenance program is to produce conditions favorable to the growth and development of a vigorous healthy turf.



Movable goals are effective traffic management tools for highly used natural turf sports fields.

All natural turf fields do not require exactly the same maintenance practices, however, any maintenance program should include attention to the following cultural practices: mowing, fertilization, irrigation, overseeding, and soil cultivation.

Mowing

Mowing once or twice per week is an acceptable frequency for many sports fields that are cut at a height of 2.0 to 2.5 inches. Mowing as often as three times per week may be necessary during periods of rapid growth (for example, after spring fertilization and rain) or when the sport requires mowing below 2.0 inches.

Natural turf fields used for sports such as field hockey, soccer and baseball are often mowed lower than 1.5 inches and require the most frequent mowing. Reel mowers are the best type of equipment for mowing at low cutting heights. Rotary mowers set below 2 inches can scalp (damage) turf rather than mow it, especially if the field has an uneven surface.

Mow sports field as often as needed so that no more than 1/3rd the height of the turf is cut off in a single mowing. This will allow return of leaf clippings without interfering with play. Returning clippings to the turf also recycles fertilizer nutrients to the turf (reducing fertilizer needs) and eliminates clipping disposal issues.

Regular sharpening and adjustment of mower blades, reels, and bedknives ensures that mowers will cut cleanly rather than tear and bruise leaf blades. Mowers that are operated every day will probably need weekly sharpening of the cutting edges. Similarly, mowers cutting turf grown on sandy soil will need more routine sharpening of dulled blades, reels, and bedknives than turf grown on loamy soils.

Employees should be thoroughly trained on the proper operation of mowing equipment and the ability to recognize the need for mower adjustments.

Fertilization

Soil test results are needed to optimize a fertilization program for a sports field. Sample the soil once every 3 years and send to a soil testing laboratory for analysis of soil acidity, nutrient status, organic matter content, and soil texture. For more information about soil testing visit the Rutgers Soil Testing Laboratory web site njaes.rutgers.edu/soiltestinglab or a commercial laboratory.

Lime. Properly managed soil does not require annual liming. Apply limestone only when soil test results indicate it is necessary (high acidity, i.e. low pH). Lime is applied to neutralize excess soil acidity and adjust the soil pH into a range of 6.0 to 6.7, which renders many essential nutrients more available to plant roots. Do not guess at the need for liming; excess liming can harm plant growth by tying up essential plant nutrients such as phosphate, manganese, iron, and others. Soil test results are used to determine whether calcitic or dolomitic limestone is needed and the amount of limestone that needs to be applied. Greater amounts of lime will be needed in soil containing more organic matter and clay, which can be assessed in a soil test. Liming is more effective after it is incorporated into the soil, so it useful to apply before any soil cultivation, especially during late summer and fall. Details on liming during the establishment of natural turf sports fields can be found in the Rutgers Cooperative Extension Bulletin E300 Turfgrass Establishment Procedures for Sports Fields njaes.rutgers.edu/pubs/publication.asp?pid=E300.

Nitrogen (N). Nitrogen is the nutrient that has the greatest impact on turf vigor and growth. Unfortunately, N recommendations cannot be developed solely from soil test results. Other important factors need to be considered including the age and vigor (health) of the turf, soil organic matter content, mowing (clipping removal), and availability of irrigation. For example, older turfs growing on high-quality soil will not require as much

Table 1. Sample nitrogen (N) fertilization program based on the intensity of play (damage to the turf) and maintenance on a sports field.

Intensity of Play & Maintenance	Approximate Timing of Nitrogen (N) Fertilization[a]				Annual
	March-April	May-June	August-September	October-November	
	pounds of N per 1000 square feet[b]				
Low	0.5	0.5	0.5	0.5	2.0
Moderate	0.8[c]	0.8	0.8	0.8	3.2
High	1.0	1.0	1.0	1.0	4.0

[a]Time the application of N fertilization to increase turf vigor immediately before and recovery immediately after intense periods of play (damage). Uptake of N fertilizers by turfgrass is most efficient when soil temperatures are warm and light-to-moderate rain or irrigation occurs soon after application. New Jersey law prohibits application of N (and P) fertilizer after December 1st and before March 1st.

[b]Adjust the amount (rate) of N to increase or decrease turf vigor based on the expected amount of damage or need for more or less recovery of turf cover and density. Multiply by 44 to convert number to pounds per acre.

[c]Use fertilizer containing slow release N at application rates greater than 0.7 pounds of N per 1000 square feet (required by law).

N fertilization as a new field constructed of poor soil. Additionally, more N is needed as the playing intensity (damage) increases on a field. Nitrogen application guidelines outlined in Table 1 can be used to develop a bimonthly N fertilization program based on the intensity of play (damage to the turf) and maintenance on a sports field.

Deviations from the suggestions in the table should be based on the condition of the turf and soil and quality expectations of the playing field. The following are some generalized relationships between N fertilization and sports field management and use expectations.

For low maintenance sports fields, older turfgrass stands, and/or sports fields subjected to minimal traffic intensity, apply N fertilizer one to two times per year at an N rate of 1 pound per 1000 square feet per application. Use a fertilizer with at least 30% slow-release-N. For spring sports such as baseball, applications during early spring followed by a mid- to late spring application are generally appropriate.

For sports fields that have intense traffic events and receive regular overseeding, apply the maximum amount of N (4.25 pounds per 1,000 square feet or 185 pounds per acre) allowed by New Jersey law. Nitrogen fertilization should be timed to mirror those periods of intense field use and overseeding. Greater fertilization is needed when recuperation of turf and development of new seedlings (from overseeding) is expected. For example, sports fields used for fall sports should have N applied several weeks before (late summer) the start of season. Make the first N fertilizer application in mid- to late-August followed by a second application in September or October to encourage turf recovery during the season as well as after fall play. Apply N at a rate of 0.5 to 1 pound per 1,000 square feet. Additional N fertilizer should be applied in early spring if the turf has not completely recovered from the damage incurred during the previous fall play. Apply N at a rate of 0.5 to 1 pound per 1,000 square feet. If there is adequate recovery of turf, spring fertilization can be delayed until the turf shows signs of reduced growth and vigor in mid- to late spring.

Fields with intense use during summer (June, July, and August) will need some N fertilization during the summer to maintain turf vigor and encourage recovery from damage. Irrigation will often be required as well. Apply N at rates between 0.3 and 0.7 pounds per 1,000 square feet as-needed to maintain turf vigor and density during summer play. Time the application to precede rain or irrigation which will enhance turf response to the fertilization. Avoid excessive applications of N fertilizer (> 0.7 pounds per 1,000 square feet) during summer which can have detrimental effects on turf and may encourage diseases such as brown patch and Pythium blight.

This discussion of N fertilization is intended to provide a reference from which to design a fertilization program. Modifications will be necessary to accommodate the varying site and environmental conditions encountered at individual facilities.

Phosphate and Potassium (K). Soil test results should be used to determine the necessity and quantity of phosphate and K applied to sports fields. Per New Jersey Law, phosphate may not be applied as maintenance fertilization without justification of need provided by soil testing. Phosphate may be applied in lieu of soil testing if turf is being established for the first time or being repaired.

Soil test recommendations for phosphate, potash and other nutrients are used to calculate the nutrient ratio needed to select a fertilizer grade that will apply the correct proportions of recommended nutrients. For more information on selecting a fertilizer grade visit profact.rutgers.edu/Pages/training_module.aspx?CID=62.

Organic Fertilizers. Organic fertilizers are fertilizers that are permissible for use in organic production systems per United States Department of Agriculture (USDA) National Organic Program (NOP) standards. Synthetic fertilizers and fertilizers that contain sewage sludge (biosolids) should not be used where a claim of organic management is being made.

Organic fertilizers typically contain a small percentage of N compared to synthetic counterparts. Thus, organic fertilizers need to be applied in large quantities of product to apply a modest amount of N. Also, organic fertilizers often contain phosphate and use of these fertilizers may result in the application of phosphate – even if it is unnecessary per soil test results. New Jersey Law allows up to a 0.25 pound of P_2O_5 per 1,000 square feet to be applied in lieu of soil testing if the fertilizer source is derived from a natural organic source.

Organic Matter Additions. A soil test for organic matter content is the primary criterion for determining whether organic matter should be added to a soil. The Rutgers Soil Testing Laboratory can determine percent organic matter for submitted samples and subsequently characterize the organic matter level (e.g. very low, low, medium, high, and very high) relative to soil texture.

Ideally, organic matter (e.g. peat moss or high quality composts) should be incorporated into soils during the sports field construction process. Composts can be applied to the surface (topdressed) of established sports fields, however, repeated applications are needed over time to avoid the development of an excessive layer at the surface. Light applications of compost applied as topdressing (~1/8-inch) followed by core cultivation (aerification) will assist in compost incorporation and minimize layering potential.

Rutgers Cooperative Extension publication E327 provides more information on best management practices for nutrient management of turf in New Jersey njaes.rutgers.edu/pubs/publication.asp?pid=E327. Visit www.ProFACT.rutgers.edu for more information on the New Jersey law for N and phosphate fertilization of turf (New Jersey Act, P.L. 2010, c. 112).

Irrigation

Where an irrigation system is available, apply water as infrequently as necessary to maintain proper growth and avoid drought-stress of the turf.

Soil texture and degree of compaction will control how much water can infiltrate and be stored in the soil, affecting the quantity and rate at which water can be applied through irrigation.

For example, turf grown on sandy soil needs to be watered more often than turf grown on loamy or clayey soils. However, sandy soils hold less water and require smaller amounts of water applied per irrigation event. In contrast, turf growing on a loamy or clayey soil should be irrigated less often but with larger quantities of water per irrigation event.

Excess irrigation wastes water to evaporation, runoff and leaching. Excess irrigation can also increase the amount of weeds that will invade a sports turf. As a general rule, thorough watering once or twice a week during drought periods is often preferable to light daily sprinkling. The exception is very sandy soil which may need irrigation three times per week during hot dry conditions. Apply sufficient water in a single irrigation event to wet the entire root zone.

Do not apply irrigation too rapidly, otherwise water may runoff and collect in small depressions (pond) on the field. If this occurs, adjust the irrigation so that only the amount of water that does not cause ponding is applied. Move the sprinkler or switch to another station (on automatic controllers) before water starts to pond. If this is not enough water to completely wet the root zone, allow the applied water to soak into the soil before apply the remaining portion of water. Repeat this cycling of irrigation and soaking until all the water is applied.

Use a soil probe to assess the need for irrigation as well as how deeply the root zone needs to be wetted. Place small rain gauges or tin cans on the turf to catch and measure the amount of water applied during irrigation. Quantify the amount (inches) of water applied during a specific time to calculate a precipitation rate (inches per hour) for the irrigation system. This information is needed to know how long an irrigation system should run to deliver the required amount of water. Under moderate temperatures, sports turf will need about one-inch of water per week to maintain growth. Thus, when it rains less than one-inch in a week, subtract the amount of rain that occurred from one-inch to estimate how much should be applied. Use the soil probe to confirm that the root zone has been adequately wetted after irrigation.

Keep in mind that irrigation is of little or no value if liming, fertilizing, mowing and other practices are neglected or done improperly.

Overseeding

Turf cover in goal creases, field centers, and penalty kick areas will inevitably thin out at some point during an intense playing season. It is essential to preemptively overseed those areas of fields that will thin out from play and potentially lose turf cover. Initiate overseeding prior to the beginning of the playing season and repeat overseeding wherever thinning of the turf is observed during the playing season. It is far more difficult to recover or repair natural turf fields with overseeding if high-wear areas have completely lost turf cover.

Overseeding is easily done with a rotary spreader before and during the playing season (before games and practices). Seed-to-soil contact is achieved by athletes' shoes "cleating-in" the seed during play. Repeated scattering of seed with a rotary spreader is preferred over a slit-seeder. The vertical blades on a slit-seeder will cause too much injury to the existing turf as well as the new seedlings from previous overseeding.

Choosing the appropriate seed for an overseeding program is critical. Perennial ryegrass seed is the best choice for routine overseeding of the high traffic zones of sports fields. Perennial ryegrass seed will germinate faster and at cooler soil temperatures than Kentucky bluegrass and tall fescue making it the best choice for overseeding during fall and early spring. Seed blends (that is, two or more varieties) of perennial ryegrass that have good tolerance to gray leaf spot disease are recommended. See the RCE publication FS1048 at njaes.rutgers.edu/pubs/publication.asp?pid=FS1048 for more information on this disease problem. There are numerous suppliers specializing in turfgrass seed for the sports turf market.

Be cautious with seed mixtures marketed as "sports turf mixtures". Many of these mixtures contain Kentucky bluegrass and tall fescue and are better suited for new establishment where there is ample time to fully establish a turf.

Applying a sufficient quantity of seed is important for overseeding to be successful. As an example, apply a perennial ryegrass blend at 6 pounds per 1,000 square feet to the area between the hash marks of a football field before every home game. The area between the hash marks on a football field is 16,000 square feet, which

will require 96 pounds (two 50-lb bags) of seed. Take notice of the high play areas after several games, if new seedlings are not keeping up with damage and turf cover is diminishing, increase the overseeding rate by one or more 50-lb bags of seed.

Soil Cultivation (Aerification)

Regular cultivation of the turf and soil is necessary on sports fields subjected to intense traffic, especially when the soil is very susceptible to compaction. Spring and fall are typically the best time for cultivation. At minimum, the high traffic areas of a sports field should be cultivated (aerated) at the end of each playing season.

Core cultivation or coring refers to equipment capable of extracting 0.5 to 1 inch diameter cores of soil to a depth of 2 or more inches (hollow tine). Objections to the soil cores brought to the turf surface after coring can be avoided by either removing the soil cores or working the cores back into the turf. Soil cores can be broken-up and returned to the turf through verticutting (vertical cutting) or drag-matting the cores. Soil cores dried to the proper water content (slightly moist but soil is not sticky) will be easier to break up and work back into the turf.

Cultivation can also be performed using a machine that creates similar-sized holes with a solid tine (does not remove a core), which enables cultivation during the playing season. Some machines use solid tines to horizontally shatter the soil and can be equipped with a seeding box so that cultivation and seeding can be done simultaneously.

Soil that is deeply compacted should be first cultivated with a deep (up to 15 inches) tine and/or rotary decompaction machines. Treatment with deep cultivation equipment has sufficiently improved many older sports turfs and, as a result, helped avoid the high costs of reconstruction. It should be noted that deep cultivation will not solve compaction problems associated with improper construction practices (that is, severely compacted subgrades that limit subsurface drainage of water).

There are numerous contractors capable of providing these services if the cost of purchasing cultivation equipment is deemed too expensive.

Frequency of cultivation is determined by the intensity of field use and severity of compaction. High-priority fields that receive intensive play will benefit from two or more cultivation treatments per season. Targeting cultivation to only the high-traffic zones of a field(s) rather than treating the entire field will allow you to treat problem areas more frequently (focusing your time and resources where they are needed most).

Core cultivation can be used in conjunction with overseeding and fertilization to repair badly damaged turf on fields or areas of a field using the following steps:

1. Core cultivate to a 2-inch depth or more in late summer (needed for loosening of the soil and enabling a slit-seeder to cut into the soil – step 3);
2. Break-up and re-incorporate the cores using a tow-behind drag mat;
3. Seed with a blend of two-to-five perennial ryegrass varieties using a slit-seeder in two directions at a minimum of 5 pounds of seed per 1,000 square feet per direction (10 pounds total). If a slit-seeder is not available, a rotary spreader can be used. However, it would be best to apply seed prior to core cultivation (aerification) to achieve better seed-to-soil contact;
4. Apply a starter fertilizer; and
5. Irrigate to maintain a moist seedbed.

Integrated Pest Management

Integrated Pest Management (IPM) is a management system that helps grounds managers anticipate and prevent pest problems from reaching damaging levels by using a wide range of control tactics. IPM strategies use control measures only when necessary, which saves time, minimizes costs, conserves energy resources, and results in the judicious use of pesticides that minimizes any adverse effects on the function and quality of landscapes.

Growing a healthy, dense, and vigorous turf is one of the best methods for reducing potential pest problems. Implementing the management practices discussed above will help maintain healthy turf and reduce pest activity on sports fields. Unfortunately, even the best implementation of management practices can sometimes fail to suppress pest activity below levels (thresholds) that negatively affect the playability and safety of sports fields.

Pest control products may be needed whenever other actions fail to adequately manage weed, insect, and disease problems. Pesticide applications on New Jersey school grounds must be made in accordance with the New Jersey School Integrated Pest Management (IPM) Law (N.J.A.C 7:30-13).

A major emphasis in an IPM program is determining (scouting) where action is needed to reduce pest problems, which can be daunting for a multi-acre facility with numerous natural turf sports field and grounds with varying uses and varying tolerances to pest problems. Examples of different uses for turf include sports fields, practice fields, physical education, school recess, passive recreation, lawns, and other general common areas. Each of these uses typically has a unique management level and threshold for pest activity. A threshold defines the point at which pest-specific actions are taken.

Management Zones

Subdividing a multi-acre facility into management zones based on turf use and threshold for pest activity helps grounds managers to prioritize scouting, actions, and allocation of resources. For example, management zones can be defined as:

A. Grounds that have the lowest threshold for pest activity and highest expectations for use such as safe footing and cushion for play or high aesthetic quality;

B. Turfs and grounds that have a moderate threshold for pest activity and moderate expectations for use such as a persistent ground cover or moderate aesthetic quality; and

C. Grounds that have the primary function of soil stabilization (no wind or soil erosion), greatest threshold for pest activity, and minimal expectations for aesthetic quality.

Examples of Zone A grounds include sports and practice fields, particularly those used by high school-aged athletes and older. Relatively low thresholds (levels) of weed, disease and insect activity can adversely affect the ability of these turfs to provide safe footing and cushion for play as well as a reliable surface for ball bounce and roll. Very good to excellent turf cover from cool-season perennial turfgrass is demanded. Another example includes high-value ornamental lawn and garden landscapes.

Examples of Zone B grounds include sports fields, passive recreation areas, and lawns where stakeholders have moderate expectation levels for playing surfaces and aesthetic quality of landscape plants. A greater threshold for weeds, diseases, and insect activity can be tolerated as the nature of the recreational activity, age of athletes, or aesthetic importance dictates. High-visibility lawns and landscape grounds and sports fields used by middle school-aged athletes may fall under this category.

Examples of Zone C grounds might include sports fields primarily used by elementary school-aged athletes, "alternate fields" that are always open to users when high value fields are closed, and naturalized landscapes. These uses typically have very high thresholds for pest activity and low expectations for aesthetic quality. Soil stabilization is the primary management concern for these grounds.

Weed Control

Grassy weeds (crabgrass, goosegrass, annual bluegrass, etc.) and broadleaf weeds (dandelion, white clover, prostrate knotweed, etc.) are highly opportunistic plants that can invade sports fields after play has reduced turfgrass cover and exposed bare soil. Midfields, goal creases, and other high traffic areas are very susceptible to the encroachment of these weeds. Practices that control traffic and maintain a dense turfgrass cover, as described previously, will significantly reduce the encroachment of weeds.

When broadleaf weed infestations exceed a threshold for a specific management zone, selective herbicides (active ingredients: 2,4-D, dicamba, MCPA, MCPP, triclopyr, clopryalid, fluroxypyr, etc.) can be used to reduce weed populations below the threshold. Fall and spring are the most appropriate times to apply herbicides for broadleaf weeds. For those sports fields receiving regular overseeding, new seedlings should be mowed 2 to 4 times before applying a broadleaf herbicide. Always carefully read and follow pesticide labels.

Sports fields and grounds with a history of crabgrass or goosegrass indicate there is a problem with maintaining adequate turf density and cover during the spring. A management program review should be performed to determine if adjustments can be made to improve turf cover. Preemergence herbicides (pendimethalin, dithiopyr, and prodiamine) can be applied to control crabgrass and goosegrass before these weeds germinate in the spring (before mid-April). Corn gluten meal is a by-product of corn milling and is generally considered to be an organic product with preemergence herbicidal activity that can be applied in a manner similar to conventional preemergence herbicides. Corn gluten meal will be more effective under low weed pressure; expect only suppression of crabgrass and goosegrass when weed pressure is great.

Preemergence herbicides (including corn gluten meal) should not be used in early spring on a sports field where large areas of turf cover have been lost (bare soil). Instead, improve turfgrass cover using either seed or sod. If applied, conventional preemergence herbicides and corn gluten meal will damage or kill new seedlings and sod and greatly limit your ability to restore turfgrass cover on bare soil. Postemergence herbicides can be used to control crabgrass (quinclorac and fenoxaprop) and goosegrass (fenoxaprop) if these weeds threaten to ruin a spring seeding.

A number of nonselective weed control products contain active ingredients defined as "low impact pesticides" by the NJ School IPM Law. These active ingredients include citric acid, clove oil, eugenol, lauryl sulfate, 2-phenethyl propionate, and sodium lauryl sulfate. These materials can be used for nonselective control of young (small) weed seedlings. Potential uses include "trimming" along fences lines and turf border edges. These products are most effective if used in spring when the weeds are small and are not recommended for the control of large, mature perennial weeds. Use of these active ingredients for spot treatment of weeds in turf will cause unac-

ceptable injury/discoloration (albeit temporary) to the established turfgrass unless care is taken to only treat the undesirable vegetation (weed). This is especially important in newly seeded turfgrass; immature turfgrass seedlings have limited potential to recover from damage by these materials.

Insect Control

White grubs are the insect pest of greatest concern for sports turf in New Jersey. White grubs are soil inhabiting pests that feed on plant roots during summer, fall and spring. Root system damage on a sports turf greatly compromises the footing needed for athletic play. Furthermore, secondary damage from raccoon, skunk and other vertebrate predators foraging on grubs will destroy the turf and render a sports field unplayable. As a result, fields used for late summer and fall play have a very low threshold for white grub populations.

Preventative applications of insecticides are typically used to avoid serious damage to sports field turfs with a low threshold for white grub damage. Curative applications of insecticides are possible but have risks. Timing of curative applications is less flexible and will overlap with play on late summer and fall sports increasing exposure risk for athletes. Soil insecticide applications never work overnight so white grub and predator foraging damage will continue for some time after the application.

Products containing insect parasitic nematode species or milky disease-causing bacteria provide biological control (low impact pesticide) options for white grubs but these products have limitations. The level of control will depend on the white grub species (4 major species), availability of water, air and soil temperature, and the method used to apply the nematodes. These products may be expensive compared to conventional insecticides and need to be used soon after delivery (living organism with limited shelf life). Nematodes tend to work better against larvae of the Japanese beetle than the other species. And the product based on milky disease-causing bacteria only affects Japanese beetle larvae. Yet, the most common white grub species in New Jersey is the oriental beetle.

For more information on white grub control, refer to Rutgers-New Jersey Agricultural Experiment Station fact sheet FS1009 An Integrated Approach to Insect Management in Turfgrass: White Grubs njaes.rutgers.edu/pubs/fs1009.

Turfgrass seed that contains endophytes will produce turf more or less resistant to billbugs, chinch bugs, sod webworms and some other leaf and crown feeding insects. Endophytes are beneficial (non-pathogenic) fungi growing within a turfgrass plant, which provides the turf with biological control of many foliar feeding insects. The seed of many new varieties of perennial ryegrass, tall fescue, and fine fescues contain endophytes. These varieties are strongly recommended for the establishment or overseeding of turf. Seed containing endophytes should be stored under cool dry conditions because the endophytes in seed are lost (killed) when stored under hot, humid conditions for an extended period of time (several months).

Disease Control

Selecting turfgrass species and varieties with improved tolerance to important diseases is an effective approach to managing disease pests. Always consider this when selecting grass seed for a new seeding or overseeding. Important examples of this approach include the use of seed blends (two or more varieties) of perennial ryegrass that have good tolerance to gray leaf spot or Kentucky bluegrass with enhanced resistance to summer patch.

Turf diseases are often present in sports turf but the levels frequently do not warrant treatment, especially when a sound management plan is practiced. Due to cost of fungicides, many facilities can only justify limited curative applications at a relatively high disease threshold. Fungicide use is reserved for diseases outbreaks that threaten loss of turf cover. See Rutgers-NJAES publication FS814 Plant Disease Control: Managing Diseases of Landscape Turf njaes.rutgers.edu/pubs/publication.asp?pid=fs814 for more information. Fungicides are most effective and can often be used at reduced rates when turf is maintained using best management practices.

Several biological disease control products, often referred to as microbial inoculants, are registered for use in turf (Table 2). These products contain microorganisms (typically beneficial bacterial or fungi) that suppress the populations of disease causing microorganisms. They are most effective when used on a preventive basis in areas with a history of disease and when disease activity is low to moderate. Efficacy of these products is usually poor when used on a curative basis or where disease pressure is high. To be effective over long periods, biocontrols products usually need to be reapplied periodically to maintain populations of the beneficial microbes at disease suppressive levels.

The term “compost tea” refers to a liquid derived from steeping compost in water. Compost teas should not be viewed as fungicides, but are more accurately described as soil or foliar inoculants intended to promote soil and plant health. Although compost teas have been shown to occasionally reduce the severity of foliar diseases in the field, research has not shown them to consistently prevent or control turfgrass diseases.

Table 2. Biological products with turfgrass disease suppressive activity.

Product name	Organism	Diseases suppressed
Companion® Biological Fungicide	*Bacillus subtilis* GB03 strain	Summer patch, brown patch
EcoGuard ®	*Bacillus licheniformis* SB3086 strain	Dollar spot
Prestop ® Biofungicide	*Gliocladium catenulatum* J1446 strain	Foliar diseases
Rhapsody ®	*Bacillus subtilis* QST 713 strain	Summer patch, brown patch
Organic Materials Review Institute (OMRI) Listed		
Actinovate® SP	*Streptomyces lydicus* WYEC 108 strain	Soilborne diseases
Regalia ® PTO Biofungicide	*Reynoutria sachalinensis*	Anthracnose, brown patch, dollar spot
TurfShield ® PLUS	*Trichoderma harzianum*	Brown patch, dollar spot

Conclusions

This bulletin describes sports field management strategies meant to produce favorable conditions for the development and growth of a vigorous healthy turf. All too often, however, only certain aspects of turf management receive attention due to budget limitations or personnel unable to identify the best practices needed to manage a specific field(s).

The implementation of a suitable sports field maintenance program requires a trained sports field manager who has the ability to both anticipate future problems and provide solutions to existing problems. Furthermore, the program must be done within a budget that supports the necessary materials, equipment, and additional trained personnel.

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