

Building an Organic Maintenance Program for Athletic Fields: Guidance from Experts and Experienced Communities

Introduction

Natural grass fields can provide a protective, high-performance surface for athletic activities. Organic field maintenance practices can improve the health of soil and grass without the need for synthetic pesticides or fertilizers. These practices include frequent aeration, frequent mowing, soil testing, and use of organic fertilizers and soil amendments. Communities and schools can accommodate a wide range of recreational activities on their athletic fields by building healthy, balanced soil and a strong root system. Organically managed natural grass fields serve as an affordable, practical and safer alternative to artificial turf.

Many schools and communities have questions on how to implement organic practices. This fact sheet provides information gathered from athletic field landscaping professionals, as well as lessons learned by individual communities that are successfully maintaining their athletic fields with organic practices. This fact sheet draws primarily upon three case studies created by the Toxics Use Reduction Institute (TURI) highlighting organically managed grass fields in [Springfield](#), [Marblehead](#), and [Martha's Vineyard](#), Massachusetts. It also draws on the experience of several sustainably managed grass athletic fields in southwest Pennsylvania and Ohio.

The information presented here represents key messages from our case studies and interviews with experts. This information is not a substitute for more detailed, site-specific advice that can be provided by natural grass and athletic field experts. Some sources for additional guidance are provided at the end of this document.

The techniques described here are useful even if your community is not committed to full organic management. These techniques can improve the sustainability of any grass field. By building healthy soil and root systems, over time these approaches also help to reduce maintenance costs.

Getting Started

There are several steps to take before creating an action plan for maintaining a healthy grass playing field using organic methods. These steps include diagnosing existing problems on the field, finding guidance, and determining whether rehabilitation or a rebuild of the field is right for your community.

A good first step is assessing the field conditions and diagnosing existing issues. For example, a field may be hard (compacted) or visibly worn, or there may be areas with puddling. It is essential to understand why these deficiencies are occurring before creating a plan of action.

There are many options and technologies available to help understand why a grass field is underperforming. Problems with grass growth are most often linked to soil health. Soil testing can identify imbalances in soil health. Results from these tests can help facilities managers or grass consultants better understand how to adjust maintenance practices to improve soil health, leading to healthier and more resilient grass coverage. Some schools or communities may choose to employ a consultant or landscaper specialized in grass athletic fields for guidance.

Soil testing

Soil testing is a critical first step to understanding the baseline physical, chemical, and biological characteristics of soil on an athletic field. Identifying imbalances within the nutrient and mineral composition pinpoints steps needed to improve grass growth in the soil. Results serve as a stepping-off point to creating a customized maintenance program for individual fields.

Soil testing can measure physiochemical characteristics, such as texture, moisture, pH, and organic content; nutrient levels important for plant growth, including phosphorus, potassium, nitrate, and calcium; and microorganisms, such as bacteria, fungi, and other beneficial soil organisms. These results reveal any imbalances in the soil, allowing for the maintenance program builder to choose specific blends and amounts of fertilizers, soil amendments (such as lime) to adjust pH, and types of soil to be added to the field to create an ideal habitat for grass growth. Using this tailored approach helps avoid overapplication of fertilizers and soil amendments, which saves money and helps protect the surrounding environment from pollution through excess nutrient runoff.



Soil sample taken in Chilmark, Martha's Vineyard.

For example, the City of Springfield used soil tests to identify imbalances in the soil before building an action plan. The variables tested are listed in Table 1. Springfield repeats these tests every two to three years in order to determine how much fertilizer and soil amendment is needed throughout the year.

Table 1. Examples of variables measured during soil testing

Physiochemical (understanding permeability, water holding capacity and other physical capabilities)	Nutrients (essential for grass growth)	Biological (helpful vs harmful microorganisms)
Texture	Phosphorus	Total organic biomass
Moisture	Potassium	Active bacterial biomass
pH	Nitrate	Active fungal biomass
Organic content	Calcium	Nematodes

Source: Osborne, Chip. 2015. *Organic Land Care Project: Springfield, MA: Technical Review*. Report provided to Patrick Sullivan, Director, Springfield Parks Department.

In another example, Heidelberg Park in the Borough of Heidelberg, Pennsylvania, was initially constructed on poor-quality soil. An initial step in improving the field was to test soil quality. The soil test, in turn, made it possible to create an appropriate plan for fertilizer use and improvement of soil health.

Finding a consultant or advisor

A consultant specialized in athletic field maintenance practices can be a valuable resource when deciding how to rehabilitate or rebuild a natural grass field. These professionals offer services including field assessments, soil testing and analysis, creation of customized rehabilitation or long-term maintenance plans, organization of maintenance logistics, and training for landscaping staff. A consultant can also provide more detailed diagnostic information, including mapping of moisture and compaction as well as assessing weed populations. Local landscapers who are educated in organic practices can also assist and provide knowledge on organic maintenance practices, and carry out the maintenance work.

When the City of Springfield decided to make the transition to organic management on their grass athletic fields and other city properties, they hired a natural grass athletic field consulting group, Osborne Organics, to help them diagnose problems and build correction plans using basic organic management techniques. Springfield also works with PJC Organics for semiannual soil testing and ordering of customized shipments of organic products each year.

The Field Fund, an athletic field management group on the island of Martha's Vineyard, hired consultants at Natural Grass Advisory Group (NGAG) to analyze and map problem areas on playing fields. NGAG uses specialized tools, such as soil probes and drone photography, to understand drainage, compaction, and other issues in specific areas of the field. Pinpointing and focusing on areas of the field that need attention instead of maintaining an entire athletic field the same way can help save on maintenance costs. Martha's Vineyard also used outside consulting services to completely rebuild a playing field complex at Oak Bluffs School.

Rehabilitation vs. rebuilding

Many communities simply wish to rehabilitate an existing field. The quality and resiliency of an existing grass playing field can be improved by adopting basic organic management practices. Other communities are in a position to rebuild a field. This choice may depend on available resources.

Rehabilitation focuses on correcting problems, such as water pooling, weeds, hard surface, or uneven grass cover, by improving the quality of the existing soil and grass. This involves understanding imbalances in soil nutrient and organic matter, and adjusting maintenance practices and/or soil amendment applications to correct these imbalances. This method may also involve changing the type of a grass seed used to something better matched for the climate or type of play. Rehabilitation is less invasive and less expensive. By simply improving the quality of the soil and grass, many may find their playing fields need no other interventions.

For example, Bethlehem Center School District in East Bethlehem Township, Pennsylvania, aimed to diagnose and rehabilitate a practice soccer field on a low budget. The field had uneven soil and patchy grass coverage. Simple steps to begin rehabilitating the field included soil testing, aerating, and fertilizing, as well as rolling to smooth out the surface of the field.

Rebuilding a playing field offers the advantage of designing a well-functioning field from the soil up. This may include using new soil with the correct amount of organic matter, engineered drainage, and an irrigation system. This method can be considerably more expensive, but may be an option for communities with the budget for new field construction.

This option is more intensive, but is possible to complete in an efficient amount of time. The Field Fund worked closely with the Oak Bluffs community in Martha's Vineyard to rebuild a 2.75-acre field. Planning for the Oak Bluffs school fields began June 27, 2018. Both fields were open for the start of the school year on September 4, 2018. The fields were playable three weeks after seeding.

Building a playing field with organic management in mind may also be easier to maintain over time. Springfield saved time and money by using organic management as soon as the playing field at Camp Wilder was constructed. The City was able to avoid restructuring the soil in the future.

Taking action

The next steps to building an organic maintenance plan depend on soil testing results and unique conditions of the field. The goal is to create a healthy environment for grass growth. Reaching this goal will create a resilient, protective athletic field with grass that can withstand play and outcompete weeds and pests. The details of the plan will depend on the starting conditions and the level of use that is anticipated for the field.

In many cases, a community may not need to take costly or time-consuming steps. Simple changes such as regular mowing and aeration, along with adjustments to fertilizer use, may be all that is necessary to reach the quality needed by the community. A spectrum of maintenance practices can be adopted depending on the community's budget and goals.

Fertilizer and soil amendments

Soil nutrient levels critical for grass growth, such as nitrogen, phosphorus, potassium, and calcium, can be modified using organic fertilizers. Natural grass specialists recommend testing soil periodically as the needs of the field change with use over time. Organic fertilizer is generally made with a combination of natural ingredients. For example, [PJC Organics fertilizer](#) is composed of soybean meal, feather meal, and potassium sulfate. Use of organic practices to increase organic matter in the soil will also reduce fertilizer needs over time.

Core organic maintenance elements include:

Fertilizer and soil amendments: Add types and amounts needed, depending on soil testing.

Seeds: Choose seeds appropriate for climate and type of field use.

Aeration: Aerate soil frequently to alleviate compaction. Aerate more often in high use areas.

Mowing: Frequently mow to an appropriate height.

At Heidelberg Park, fertilizers and soil amendments were added to the field in order to build soil health and foster the development of a robust root system. Products were chosen to replenish basic nutrients as well as supporting the growth of beneficial fungi.

In some cases, fertilizers cannot be used on an athletic field. On Martha's Vineyard, a field in Chilmark cannot be fertilized due to its close proximity to a wellhead. Instead, The Field Fund plans to use organic liquid worm casting as a nutrient source.

Tip!

Weed growth and issues with grass growth can tell you about specific problems with the soil. Here are a few examples:

- Dandelion growth can indicate low pH in the soil, which may be alleviated with the addition of calcium.
- Dollar spot can indicate low nitrogen, drought stress, and excess thatch, which may be alleviated by adjusting fertilizer, applying compost, and irrigating.
- Patches of dead grass may be due to grubs, which may be alleviated by adding beneficial nematodes.

Source: Grassroots Environmental Education. Grassroots healthy lawn program: six steps for organic lawn care. https://www.grassrootsinfo.org/pdf/six_steps.pdf

Use of soil amendments also depends on soil testing, and may include addition of soil conditioner, compost, or lime. Each of these amendments serves to improve a part of the soil's composition. The [soil conditioner](#) used by PJC Organic is made of charcoal, kelp, soybean, and molasses, and is used in the spring to help jump-start microbial activity in the soil. Compost adds organic matter, provides macro- and micronutrients, and increases soil moisture retention and porosity. Adding compost can also increase diversity of microbes, including fungi and nematodes, which can improve disease resistance. Lime is generally made from ground limestone rock, which contains magnesium carbonate and calcium carbonate. Addition of lime helps correct soil pH, allowing grass roots to take up nutrients and minerals.

Seed selection

Selecting the appropriate type of grass seed is critical to maintaining the long-term health of athletic playing fields. Individual grass species offer different protective capabilities, such as heat or cold tolerance, drought resistance, deep root systems, and weed resistance. A combination of grass species can be used to create a resilient play surface to match the climate. For example, The Field Fund on Martha's Vineyard uses a combination of high-quality perennial ryegrass and Kentucky bluegrass. This seed combination creates heat-tolerant, durable fields that are able to support heavy use nearly year round.

At Denison University in Granville, Ohio, the varsity soccer field is planted with bermudagrass and ryegrass. Bermudagrass goes dormant in winter, whereas ryegrass goes dormant during hot weather. In combination, the two grass types provide a durable play surface usable in multiple seasons.

Tip!

Bare spots are signs that the soil is compacted or soil chemistry is out of balance. Fill in bare spots by adding top soil and grass seeds at any point during the year.

There are several methods used to add seeds. Slit seeding uses a slice aerator to create holes to drop the seeds under the soil surface and typically performed twice per year. Overseeding uses a spreader to scatter seeds on the soil surface. Finding the best time of year to overseed will depend on the grass seeds being used. For example, the best time to plant perennial rye grass in colder climates is in the fall.

Aeration

Aeration is arguably the most important step for maintaining healthy grass. Aeration relieves compacted soil and dethatches grass to allow air, water, and added nutrients to penetrate the soil. Relieving compaction can improve drainage, decrease the need for irrigation, and create a softer, more protective playing surface. Aeration is accomplished by pulling up plugs of soil and grass or by slicing into the soil using a riding or push machine. Consultants typically recommend aerating several times per year. Springfield sees best results when fields are aerated four times per year. However, high traffic areas will benefit from more aeration. The Field Fund in Martha's Vineyard aerates the entire fields two to three times per year, and high traffic areas an additional one or two times per year.



Aerating a field in Springfield, Mass.

Mowing

A mowing program works best when adjusted to accommodate changing growth rates and summer heat. Consultants suggest mowing regularly to avoid cutting more than one third of the grass blade at one time. Some experts recommend grass be mowed high (3 to 3.5 inches) to encourage deep roots and to shade the soil. Others focus on benefits from cutting grass more frequently to a shorter length. Fields often require mowing twice per week during the peak grass growing months, and once per week

Tip!

Ensuring the mower blades are sharp will greatly improve grass health and help it grow evenly. Sharpening services may be available at lawn equipment stores or local golf courses.

at other times. Sharpening mower blades is important to prevent tearing or damage of grass blades, as damaged grass blades lose moisture and are more susceptible to disease. Local golf courses are sometimes willing to sharpen mower blades for community maintenance programs. It is also important to avoid mowing wet grass.

Irrigation

Depending on climate and annual rainfall, irrigation may be needed to supply adequate moisture to soil and grass. It is essential to ensure irrigation systems are adjusted properly to evenly water a field. Controllers can be used to help conserve and direct water to certain areas of fields. The Field Fund uses

Tip!

Each sport creates different areas of high impact on fields, leading to compaction of grass and soil in certain areas. Move goals, nets, and other equipment periodically to avoid concentrating heavy use in certain areas of the field.

a "smart" irrigation controller called a HydroPoint, which aids in irrigation and the conservation of water.

An irrigation system may not be necessary. Focusing on increasing organic matter content in soil, decompacting soil, and choosing drought tolerant grass may allow for rainfall to provide enough moisture throughout the growing season.

Special technologies

The team at The Field Fund in Martha's Vineyard uses some [specialized technologies](#) to help pinpoint problem areas on the field. Directing resources to targeted problem areas rather than the entire field can help reduce cost. One of these technologies is a wireless sensor tool called POGO that measures soil water content, soil salinity, field surface temperature, and GPS location. These data are used to create a map to identify specific areas on the field in need of extra maintenance. Low soil moisture is an indicator of compaction or low organic matter content. The Field Fund also uses drones to identify wear patterns in the fields as well as helping to monitor irrigation function.

Long-term maintenance

The key to sustaining healthy soil and grass is to keep up with regular maintenance. Several resources mentioned at the end of this document offer month-to-month calendars of recommended organic maintenance schedules. These resources are geared primarily towards lawn care, but many of the points they include can be useful for athletic field maintenance as well. The PJC Organics website provides [educational resources](#) including a month-to-month calendar for guidance on organic grass with cultural practices and product recommendations, and a list of "10 Steps to an Organic Lawn." The Grassroots Environmental Education website provides a PDF guide that gives steps accompanying a [month-by-month schedule](#).

Whether rehabilitating or rebuilding a field, it is crucial to educate groundskeepers and staff about new organic maintenance practices including equipment and schedules for soil testing, mowing, aeration, and fertilization to maintain the long-term health of fields. It is also important to coordinate maintenance responsibilities with school and town representatives to ensure that maintenance activities do not disrupt regular field use.

Resources

Below are a few natural-grass consulting and educational organizations that focus on the use of organic management techniques. Note that TURI does not endorse any specific provider.

- [The Phipps Conservatory](#) provides a Sustainable Landcare Accreditation course. This is an intensive training course for landscape and lawn care professionals, focusing on organic landcare techniques.
- [Northeast Organic Farming Association \(NOFA\)](#) supports organic practices in New England through education on organic land care topics including fertilizers and soil amendments, pest management, disease control, and others. NOFA also offers soil technical assistance services such as [soil testing](#). They also offers a search tool to find local organic landscaping services and money-saving bulk order programs for products. NOFA also hosts an [accreditation course](#) in organic land care for land care professionals.
- [Grassroots Environmental Education](#) is a New York-based non-profit organization with a mission to educate the public about the links between common environmental exposures and human health, including use of pesticides and synthetic turf. They have created an organic lawn and landscaping program to educate and train professionals in organic grass care. They also offer a number of educational resources on their website including a [healthy lawn care document](#) describing “six steps for organic lawn care.”
- [IPM Institute of America](#) provides a range of services to help reduce pesticide use, support pollinator health, support sustainable agriculture, and support integrated pest management for schools, among other activities. [Midwest Grows Green](#), an initiative of the IPM Institute of America, provides information on techniques for reducing pesticide and fertilizer use, drawing upon on a range of community-based projects. Midwest Grows Green has created [guidance for athletic fields](#), and provides informational templates for a small fee.
- [PJC Organics](#) is a small organic grass consulting company and organic fertilizer and soil amendment manufacturer located in Massachusetts. The company offers diagnostic services including site visits, soil testing guidance, and maintenance program development. PJC Organics analyzes soil test results in order to recommend products, application amounts per acre, and application schedules for individual fields. PJC Organic's website also provides resources including a [month by month breakdown](#) of organic field care and resources to help [connect with local landscapers](#) for field needs.
- [Osborne Organics](#) is a consulting group that specializes in helping municipalities and institutions improve the quality of their playing fields by transitioning to organic grass management. Osborne Organics builds custom rehabilitation and long-term maintenance plans base on comprehensive assessments of fields, soil testing, and understanding current and past cultural and product management practices. They also provide training for landscape professionals and property managers on best practices in organic grass management. TURI [interviewed Chip Osborne](#) of Osborne Organics to help communities better understand how organic management of grass can improve the quality of grass without use of pesticides or synthetic surfacing materials.

- [Natural Grass Advisory Group \(NGAG\)](#) is a consulting group that combines core principles of natural grass maintenance with data collection and newer technologies to strengthen grass on athletic fields, allowing for more play time and better resilience. NGAG provide basic services such as soil testing, but also use sensors to measure both environmental and performance variables on field surfaces. They build maintenance plans focused on alleviating compacted areas, increasing organic matter, and balancing soil chemistry. NGAG also provides workshops, on-site training, and seminars about different aspects of maintenance and budgeting for organic maintenance.
- [EarthWorks](#) manufactures carbon-based fertilizers and other soil additives for grass and landscaping. Their staff includes agronomists that can share advice on products and growing healthy grass using sustainable methods.
- The Town of Wellesley Natural Resources Commission created a [guide for reducing pesticide use](#) through organic land care.

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