NJ AGRICULTURAL EXPERIMENT STATION
RUTGERS
COOPERATIVE RESEARCH & EXTENSION

For a comprehensive list of our publications visit
www.rcre.rutgers.edu

E300

Bulletin

Turfgrass Establishment Procedures for Sports Fields

James A. Murphy, Ph.D., Extension Specialist in Turfgrass Management & Bradley S. Park, Sports Turf Research and Education Coordinator

Establishing a durable and safe sports field will require soil testing and proper site preparation. The initial investment in site preparation should be considered over the many years that a field will provide recreational use. For example, improper root zone construction and grading will inhibit the movement of water away from the playing surface and consequently increase the duration of wetness of the field(s), particularly during wet weather. This condition will lead to more rapid deterioration of the playing field, more frequent closure of the field(s) due to wet unplayable conditions, and ultimately may produce unsafe playing conditions. Research has demonstrated that the rapid germination and growth of turfgrass is critical for a successful establishment of athletic field turf. Listed below are the major points to consider when establishing turfgrass on sports fields:

A. Grading and Tillage

All rough debris including large stones, parts of tree branches and roots, etc. must be removed. Unless sand-based root zone construction is used, a gentle sloping grade (1 to 1.5% slope) away from the central areas of play on a field is strongly recommended; this is often referred to as "crowning" the field. Additionally, any incorrect surface grades or depressions in the grade will result in water collecting in those depressions, particularly where the soil does not have adequate internal drainage properties. Because surface drainage (crowning) is not the most effective (rapid) method to drain athletic fields, properly designed and correctly installed vertical slit and/or subsurface drainage systems are critical when field use may coincide with wet conditions. In many instances, money spent on improperly designed and installed, and non-functional subsurface drainage systems, amounts to a complete waste of resources. Therefore, it is important to understand the site, soil conditions, and method of construction to determine which surface and subsurface drainage methods are appropriate.

Finer-textured (clayey) soils compact easily with grading and traffic; therefore, these soils should not be graded while wet. Moreover, some tillage during rough grading and final grading processes may be necessary. Tillage is needed to improve soil physical properties such as water infiltration and percolation, water retention, and soil temperature. As part of the seedbed preparation process, proper tillage stirs and loosens the soil, improves aeration through alleviating compaction, and creates a suitable medium for turfgrass growth.

A reasonable approach to tillage involves loosening the top 8-inches of soil using conventional tillage equipment and subsequently firming the top 4-inches of the profile with more shallow tillage to allow turfgrass establishment. Tillage must be timed so that finer-textured soils are not excessively wet; thus, summer months are typically a good time for these operations. More specific recommendations on the timing and type of tillage are provided below in the context of other procedures involved in soil preparation.

THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS
COOK COLLEGE

B. Soil Preparation

It is very important to properly prepare the soil using the steps outlined below before seeding or sodding.

1. Soil Testing

Any field that is being prepared for seeding or sodding should be sampled for soil testing. Recommendations for the application of lime, phosphorous (P), potassium (K), and other nutrients can be obtained from soil tests. While nitrogen (N) recommendations can be made in a soil test report, the recommendations are not based on soil analysis. Fields having different soil types, fields with different vegetation or management histories, or fields having substantially different fertility levels, as determined by previous soil test, should be sampled separately. Conversely, fields having similar soil types, having similar vegetation and management histories, and having similar fertility levels, as determined by past soil tests, may be lumped together into one sample. Once established, sampling a field every three (3) years is generally sufficient to monitor soil pH, P, and K levels; however, it is advisable to sample soil before any reseeding or overseeding. County Cooperative Extension Offices can assist in obtaining information on the proper methods of sampling and interpretation of soil tests results. More information can be obtained at *www.rce.rutgers.edu/soiltestinglab/default.asp*.

2. Liming

Proper liming is essential for vigorous and healthy root and shoot growth of turf. Applied fertilizer and other soil nutrients will be used more efficiently by the germinating turfgrass seedlings or newly transplanted sod when the soil is at the proper pH (6.5 to 6.7). The adjustment of soil pH is considerably more effective if materials are incorporated into the soil before seeding rather than after seeding with surface applications. Thus, it is vital that soil testing be performed before seeding so that proper amounts of lime can be incorporated into the soil during the preparation of the field for seeding or sodding. *Note:* lime, P, and K can be applied and incorporated in the soil at the same time.

a. Apply the recommended amount of lime (and P and K fertilizer where large amounts are needed, see section B.3.a. below) and incorporate uniformly into the soil (6 to 8 inches deep). This can be applied prior to the deepest tillage operation (i.e. moldboard plow).

b. If the amount of lime required exceeds 200 pounds per 1000 square feet, apply one-half of the recommended lime, incorporate into the soil (6 to 8 inches deep), and then apply the remainder and incorporate into the soil at ½ the depth of the previous tillage (3 to 4 inches). Examples of equipment for this tillage operation could be a field cultivator, rotavator, or rototiller.

3. Pre-plant Incorporated Fertilizer

a. The adjustment of P, K, and possibly other nutrients is considerably more effective if materials are incorporated into the soil before seeding rather that after seeding with surface applications. Thus, it is vital that soil testing be performed before seeding so that proper amounts of P and K can be incorporated into the soil (preferably at the same time as liming) during the preparation of the field for seeding. Soil requiring extensive changes in pH, P, and/or K levels deep within the soil profile (greater than two [2] inches) should not include N in those deep incorporation applications. Placing N too deep within the soil profile will increase the probability for leaching.

b. After incorporation of lime, P and K, evenly broadcast N fertilizer or a “starter” fertilizer recommended by soil testing. While irrigation and rainfall are sufficient to adequately incorporate applied N, additional tillage may be performed; however, this tillage operation should not be made below a 2.0-inch depth. The nitrogen component of the fertilizer should be applied at 1 to 2 pounds of N per 1000 square feet (45 to 90 pounds per acre); preplant fertilizer rates of N above 1 pound per 1000 square feet should include a slowly available nitrogen source (30–60% of N slowly available) in the fertilizer. Slowly available forms of N include sulfur-coated urea, IBDU, methylene urea, polymer coated urea, or natural organics. Surface fertilizations of N that

are lightly tilled (incorporated no more than two [2] inches) should be applied separately from (after) deep incorporation of lime, P, and/or K and before seeding. After the emergence of seedlings, surface applications of N (typically a soluble source; see section on N applications below) are applied when a decline in shoot color, growth, and vigor is evident.

4. Soil Amendments

These include peat moss, high quality composts, biosolid products, sand, gypsum, etc. are best considered during the development of specifications for the initial construction or re-construction of a field. Very sandy or finer-textured (clayey) soils often benefit from the addition of organic matter to improve physical and nutritional properties of the soil and provide more rapid turfgrass establishment. Amending the soil of athletic fields should be based on soil testing and interpretation by a skilled agronomists/horticulturalist with sound knowledge and experience in athletic field construction. Rutgers Soil Testing Laboratory (*www.rce.rutgers.edu/soiltestinglab/default.asp*) can provide some of the testing as well as recommendations for other laboratories and persons capable of conducting the necessary test procedures and interpretations of those results.

C. Seeding

1. Timing

Late summer and early fall provide the most ideal conditions for turfgrass establishment and will allow adequate turfgrass growth before winter. Cool evenings, moderate daytime temperatures, and more abundant rainfall are conducive to rapid seedling emergence and sod rooting. Additionally, many weeds including crabgrass are no longer germinating, thus reducing weed competition in new turfgrass plantings.

a. Primary Establishment Time—late summer, early fall. (The earlier date is most desirable.) Southern New Jersey (Trenton and south), August 20 to October 10; Northern New Jersey (Trenton and north), August 15 to October 5.

b. Secondary Establishment Time—March 15 to May 15 (All of New Jersey and highly dependent on soil water content and weather).

Prepare the soil during the first warm dry period as soon as soil is dry enough to work without forming clods. Preparing soil when it is too wet will compact the soil and result in poor seedling emergence and non-vigorous root and shoot growth.

2. Seed Selection

Turfgrass breeding has made many advances in recent years. There are now Kentucky bluegrass varieties with better adaptation to traffic stress as well as greater disease resistance. Tall fescues were previously considered too stemmy and coarse; however, finer textured, lower growing, denser, and darker-green tall fescues are now available. Perennial ryegrasses have been extensively used for sports turf and are widely available in the commercial market. Bermudagrass is a very successful warm-season grass used for sports turf in more southern climates; its use in New Jersey, however, is limited because of the great potential for winterkill. Species including the fine fescues (i.e., hard fescue, creeping red fescue, and Chewings fescue), creeping bentgrass, colonial bentgrass, velvet bentgrass, and zoysiagrass are not currently recommended for athletic field turf in New Jersey.

Seed mixtures are commonly used for seeding athletic fields. Such mixtures are intended to extend the range of performance characteristics of the turf. Note that seed blends of well-adapted varieties are acceptable for athletic fields as well. A brief description of the performance characteristics of the major species of turfgrass, and seed blends and mixtures is outlined below.

a. Kentucky bluegrass (*Poa pratensis*) is a widely used grass in New Jersey. It is hardy, widely adapted, and recognized for its pleasing color and leaf texture. Many varieties have improved disease resistance and traffic tolerance. It is suitable for moderately to well-drained soil but is slow to establish from seed, thus, it is usually recommended to establish from sod. Spreading underground rhizomes (stems) enhance recovery from injury and fill in voids. A seeding rate

of 2 to 3 pounds per 1000 square feet (90 to 130 pounds per acre) is recommended. See Rutgers Cooperative Research & Extension Fact Sheet, (FS545), "*Kentucky Bluegrass Varieties for New Jersey Sports Fields*" (*www.rce.rutgers.edu/pubs/pdfs/fs545.pdf*).

b. Tall fescue (*Festuca arundinacea*) is a bunch-type grass with a coarser leaf texture and density than Kentucky bluegrasses. Improved turf-type varieties of tall fescue have attractive leaf color, texture, and density. Tall fescue will persist in moderately to well-drained, infertile soils. Tall fescue will establish fairly rapidly from seed but requires at least several months to a year to develop excellent wear tolerance. Therefore, tall fescue seeding should not be used for new fields that will be put in play within a matter of weeks, rather sodding with mature tall fescue turf is recommended in this circumstance. Mature tall fescue turf has excellent drought, heat, and insect tolerance. It is resistant to many diseases, but will suffer from brown patch during hot humid weather. Tall fescues will typically recovery quickly from damage caused by brown patch disease once the weather cools in late summer. Seeding rates for tall fescue range from 4 to 8 pounds per 1000 square feet (175 to 350 pounds per acre, Table 1). See Rutgers Cooperative Research & Extension Fact Sheet, (FS544), "*Tall Fescue Varieties for New Jersey Sports Fields*" (*www.rce.rutgers.edu/pubs/pdfs/fs544.pdf*).

c. Perennial Ryegrass (*Lolium perenne*). Turfgrass breeding has produced varieties of perennial ryegrass which are markedly improved over the older non-persistent varieties including "Linn" and "Nui", which continue to be sold in the marketplace. Perennial ryegrass is generally not as hardy as a well-established Kentucky bluegrass or tall fescue turf. The newer turf-type perennial ryegrasses have excellent color and fine leaf texture. Perennial ryegrass will grow in a range of soil conditions except for extremely wet and poorly drained areas. Perennial ryegrass demonstrates extremely rapid emergence from the soil and can germinate at temperatures just above freezing. For this reason, perennial ryegrass is successfully used in overseeding programs. Seeding rates for perennial ryegrass are 4 to 8 pounds per 1000 square feet (175 to 350pounds per acre, Table 1). See Rutgers Cooperative Research & Extension Fact Sheet, (FS546), "*Perennial Ryegrass Varieties for New Jersey Sports Fields*" (*www.rce.rutgers.edu/pubs/pdfs/fs546.pdf*).

Table 1. Seed blends and mixtures and seeding rates suggested for intensively used turfs.

Turfgrass Species	Amount of Seed % by weight	Seeding Rate‡ pounds per 1000 ft^2
Kentucky bluegrass†	100%	2 to 3
Perennial ryegrass†	100%	4 to 8
Tall fescue†	100%	4 to 8
Kentucky bluegrass & Perennial ryegrass	80–85% / 15–20%	3 to 4
Tall fescue and Kentucky bluegrass	85–95% / 5–15%	6 to 8

† Use at least three (3) cultivars in seed blends.

‡ Note: A greater seeding rate is suggested for spring seedings because of less favorable growing conditions compared to seeding rates that may be successful for seeding during the late summer and fall.

3. Seeding

Final seedbed preparation, seeding, and incorporation of the seed into the soil at the proper depth is critical. Areas to be seeded should be raked to remove objectionable debris such as stones, large clods of soil and organic debris. Objects large enough to interfere with seed placement and which may be struck by mower blades (especially stones) should be the major focus of this effort. Ideally, seeding should be accomplished by use of a "slit/slice-seeder" or a "drop-type" spreader; cyclone-, rotary-, or spinner-spreaders are only acceptable under calm (no wind) conditions. A cultipacker-seeder can be used to successfully achieve turfgrass establishment as it can provide uniform seed distribution, seed placement at a desired depth, and a firming of the surface around the seed to ensure good seed-to-soil contact. Seeding in two directions is preferred, applying ½ the recommended amount of seed in each direction. If seed was applied by a spreader (broadcast) to the soil surface, the seed should be lightly incorporated into the soil ¼- to ½-inch depth and the area should be lightly rolled, but not overdone to avoid compaction of the soil. Incorporation of the seed can be achieved by cultipackers or traversing over the site with turf equipment equipped with "knobby" tires (i.e. bunker rake machines, etc.). Rolling with a light-weight turf roller or cultipacker breaks-up soil clods, smoothes the soil, and improves seed-to-soil contact.

D. Post-Plant ("Topdress") Fertilizer

After the emergence of seedlings, surface applications of N (typically a soluble source) are applied when a decline in shoot color, growth, and vigor is evident. Applying nitrogen fertilizer to young turfgrass seedings or newly transplanted sod promotes rapid shoot and root development.

Additional N fertilizer should be applied 4 to 6 weeks after turfgrass emergence. Apply ½ to 1½ pounds of N fertilizer per 1000 square feet based on shoot and root growth rate; use a higher N rate when turf growth and color indicates establishment is delayed (slow non-vigorous growth and light green or yellow-green color). Fertilizer rates of N above 1 pound per 1000 square feet should include a slowly available nitrogen source in the fertilizer. Use fertilizers containing 30–60% of the N in slowly available form. A complete fertilizer containing phosphorus, potassium, or other nutrients will not be necessary at this time presuming the required amount of those nutrients, as determined by soil testing, was applied during earlier soil preparation procedures.

1. Do not apply fertilizer to "damp" grass seedlings as some fertilizer may cause plant "burn" if the fertilizer granules stick to moist plant leaves.

2. Watering-in the fertilizer application is very useful if rain is not imminent. Water is needed to move the fertilizer into the soil where turfgrass roots can uptake the N. Watering-in fertilizer applications can also remove granules that have stuck to turfgrass leaves, which may cause burn.

E. Water Management

1. Irrigation

A newly seeded field needs to be kept moist in the top 2 inches of soil through irrigation or rainfall. Very poor establishment will occur if this surface layer of soil dries out before a root system becomes established. Some temporary surface drying is acceptable but should be minimized until seedling emergence is complete. Once seedlings have an established root system, watering should be less frequent. At this stage of turfgrass development, a deeper (3 to 6 inches) wetting of the soil should be practiced. Irrigation should not be overdone; a persistent soft, muddy condition is an indication of over-watering. Observe the drier areas of the field for early signs of wilting. Irrigate immediately if drought stress is observed. Rutgers Cooperative Research & Extension publications FS555 and E278 provide general guidelines for irrigating turfgrass and can be found at *www.rce.rutgers.edu/pubs/pdfs/fs555.pdf* and *www.rce.rutgers.edu/pubs/pdfs/e278.pdf*, respectively.

2. Mulching

Mulching is recommended when irrigation is not available. Mulching increases water retention in the soil and allows for longer dew retention into the

morning. Both hasten seedling emergence, growth, and minimize the need for watering. Straw mulch must not be rotted, and attempts must be made to use weed-free straw. It may be difficult to obtain a weed-free straw source; therefore, other mulching options such as PennMulch®, fiber mulching, or hydromulching should be evaluated. Sources of straw mulch include wheat, oat, rye, or salt hay and can be applied at 50 to 90 pounds (1 to 2 bales) per 1000 square feet. A uniform distribution of the mulch over the site is necessary. Light mulching, where approximately 25% of the soil is visible through mulch, is all that is needed in most situations. Use as little mulch as necessary if removal of straw is not scheduled following seedling emergence. Applying chopped mulch via mechanized equipment may allow for more uniform distribution of mulch compared to utilizing baled mulch and applying it by hand across newly seeded sites.

Hydroseeding is sometimes used to apply seed to soil; however, this technique is typically more expensive and is no more effective (sometimes less) than incorporating seed into the soil. Hydroseeding is more appropriately used for situations where steep embankments prevent the safe operation of soil preparation and seeding equipment. A hydromulch or fibermulch material should be used in conjunction with hydroseeding.

F. Weed Control

Weed competition during the establishment period is one of the major reasons for failures in turf seedings. This is especially true for spring seedings at the time when many weed seeds will germinate. Consider the application of herbicides for broadleaf weeds and crabgrass (see Rutgers Cooperative Research & Extension publications FS385 at *www.rce.rutgers.edu/pubs/pdfs/fs385.pdf* and E233 at *www.rce.rutgers.edu/pubs/pdfs/e233.pdf* for detailed information). Use only herbicides that are labeled for NEWLY SEEDED turf and follow label directions.

G. Mowing

Mow as soon as leaves reach a height of about 3¾ inches for a field that will be mowed at 2½ inches (3 inches for a field mowed at 2 inches, and 2¼ inches for mowing at 1½ inches). Thus, mow as frequently as necessary to remove no more than 1/3rd of the height of the leaves in a single mowing. Light-weight walk-behind mowing equipment must be used if the field is soft from irrigation/rainfall until the soil will support larger heavier riding mowers.

Set mower(s) to cut no closer than 1½ inch unless management expertise, budget, and other resources are sufficient to justify a lower mowing height. Keep mower blades and bedknives sharp and properly adjusted at all times.

H. Sodding

Advantages of sod to establish a new turf (or renovate) include (i) immediate cover of soil that eliminates dust and mud and provides protection against soil erosion or washouts, (ii) reduced time to establishment and use of field, (iii) eliminates the risks of seeding failure, and (iv) elimination of weed problems such as annual bluegrass, crabgrass, chickweeds, and other weeds that normally threaten newly seeded turfs.

Summer or late fall timing for establishment of turf makes the likelihood of a successful seeding, highly risky. Moreover, certain species including Kentucky bluegrass and tall fescue are often too slow to establish once the timeline of a project has been delayed. Under these situations, a rapid development of a mature cover of turfgrass is most critical and the best choice to establish turf will be sodding of the critical areas.

***Note*:** When sodding is not feasible (i.e., affordable) yet the project timeline demands turf be established outside of the recommended timing for seed and/or in a very short period of weeks to a couple months, the use of a seed blend containing improved, turf-type perennial ryegrass is often used because it is the only species capable of **possibly** achieving a reasonably well established turf in such a restricted timeline. Please be aware that such a young seedling turf of perennial ryegrass is not an equivalent substitute for sodding, nor is it an equivalent substitute for seeding at the recommended timings discussed above in

section C.1. This method and time of establishment is not recommended.

1. Select High-Quality Sod

High-quality sod contains a blend or mixture of desirable turfgrasses including Kentucky bluegrass and/or tall fescue. Kentucky bluegrass is the most popular and extensively used in New Jersey sod production. Many varieties of Kentucky bluegrass and tall fescue are used, a summary of recommended sod blends and mixtures can be found at *www.rce.rutgers.edu/pubs/pdfs/fs738.pdf*. Recent traffic trials indicate the following Kentucky bluegrass varieties have excellent tolerance to traffic: 'Princeton 105', 'Avalanche', 'Award', 'Midnight II', 'Tsunami', 'Nu Destiny', 'Ginney', 'Cabernet', 'Awesome', 'Barrister', 'Odyssey', 'Total Eclipse', 'Beyond', 'Impact', 'Liberator', and 'Bariris'. Sod containing improved tall fescue varieties, often in combination with a small percentage (10% by weight) of Kentucky bluegrass, is available. Tall fescue can be used for either higher or more moderately maintained sports fields. Be sure that the sod selected is of high quality and grown on a well-managed sod farm. Although it is infrequently used, the New Jersey Department of Agriculture has a sod certification program that can be used to monitor and certify the quality of sod grown for a project. At minimum, the sod farm should be visited to observe the condition of the sod that will be purchased, harvested, and delivered.

2. Prepare the Soil before Sodding

Although sodding provides an immediate attractive cover, it is no escape from proper preparation of the soil before placement. Sod transplanted on shallow soil or carelessly prepared areas will not produce satisfactory results.

a. Grading and Tillage—The site must be properly graded and tilled as discussed above in section A.

b. Soil Testing—Test soil as discussed above in section B.1.

c. Liming—The soil should be limed as discussed above in section B.2.

d. Pre-transplant Fertilization—The soil should be fertilized as discussed above in section B.3. before the sod is transplanted.

3. Placing (Transplanting) Sod

Smaller rolls of sod can be purchased and manually transplanted on site, as is commonly done for lawns. However, large "big roll" sod is typically recommended for a sports field to hasten the time of installation and reduce seams in the field. Big roll sod requires specialized equipment for transplanting, which is generally provided by the sod grower selling the sod. Placing sod using either size is a relatively simple procedure, but it requires adhering to the procedure outlined below to be successful.

a. Prepare the area before scheduling delivery of sod ensuring a relatively dry smooth firm surface on which to place the sod. Moisten the soil with a light watering if it is powdery dry.

b. Place sod immediately after delivery, within 12 hours in warm weather. With cooler temperatures, it can be kept for several days if necessary; store in shaded area if feasible.

c. Unfold or unroll the sod strips in place and carefully fit edges together. Avoid overlapping edges and space (gaps) between sod strips. Stagger placement of the strips to give a staggered brick-type effect. On surrounding areas of fields where slopes may be significantly greater than the field, begin laying sod at the bottom of slopes, placing the strips horizontally.

d. Roll lightly using equipment with wide low-pressure turf tires or light-weight turf rollers immediately after placement to improve contact of sod with the soil. Do not use pavement rollers for firming transplanted sod.

e. Water thoroughly as soon as a sizable area is sodded, within 30 minutes on hot days.

f. Maintain a moist condition by watering as frequently as needed to avoid letting the sod and underlying soil dry out. The period from

placement to knitting into the soil is very critical. Check the moistness of the sod by lifting corners of sod pieces occasionally and observing water status. Soil should remain moist to at least the ½-inch depth below the sod. Do **not** over-water the sod, this will slow establishment or worse cause the sod to fail; free water in the sod that "squishes" underfoot is a sure sign of over-watering.

4. Post-sodding Maintenance

A high-quality sod properly placed will immediately impart an attractive appearance of a well-groomed mature turf. Growth of both leaf blades and roots will begin at once. Usually within a week, the roots will show signs of knitting to the soil (note that rooting of sod may be very slow when laid in hot summer weather, i.e., temperatures above 85°F). Proper cultural management is needed to encourage rapid knitting (rooting) of the sod as well as vigorous healthy shoot growth.

a. Mow as soon as leaves reach a height of about 3¾ inches for a field that will be mowed at 2½ inches (3 inches for a field mowed at 2 inches, and 2¼ inches for mowing at 1½ inches). Thus, mow as frequently as necessary to remove no more than 1/3rd of the height of the leaves in a single mowing. Set mower(s) to cut no closer than 1½ inch unless management expertise, budget, and other resources are sufficient to justify a lower mowing height. Keep mower blades and bedknives sharp and properly adjusted at all times. Use lighter weight walk-behind mowing equipment if the field is soft and until the sod and soil will support larger heavier riding mowers.

b. Watering—As the sod knits to the soil and develops roots, change to a less frequent but thorough watering program. Wetting the soil to a depth of 6 inches once every few days during drought periods is adequate for most soils. Very sandy soil without a construction system to hold (perch) water may require more frequent watering during hot dry weather (every day). Once the sod is fully rooted, watering is only needed during drought conditions.

c. Fertilizing—Newly sodded fields previously soil tested and appropriately fertilized before sodding will contain adequate nutrients four (4) to six (6) weeks after transplanting. Symptoms that indicate fertilization is needed include a loss of green color and slow growth of leaves, particularly if soil water content is adequate (no drought). Apply N fertilizer at the rate of ½ to 1 pound per 1,000 square feet to restore vigorous growth and color. Repeat fertilizer applications when symptoms indicate the need for more N. Fertilize adequately but do not over-fertilize, particularly during the summer months. A reasonable approach would be to utilize fertilizers containing 30–60% of the N in a slowly available form. Excessive growth as evidenced by the need to mow 3 or more times per week and very dark green color are sure symptoms of too much N fertilizer. See section D.1. above for more details on post-plant fertilization procedures.

d. Aerification and Topdressing—A well-designed and properly prepared soil (root zone) should encourage rooting and knitting of the transplanted sod. However, layering caused by differences in the soil on-site versus the soil attached to the sod can result in the need for aerification and topdressing. These practices disrupt and correct problematic layering. Consultation with an experienced agronomist may be needed to develop a program that will adequately address such issues.

Successful turfgrass establishment can be achieved if these recommendations on grading and tillage, soil preparation, seeding or sodding, post-plant fertilization, water management, and weed control are implemented. Modification or elimination of any of these recommended procedures significantly increases the risk for poor turf establishment and possibly failure. Once established, fields must be adequately maintained. Rutgers Cooperative Research & Extension Fact Sheet, (FS105), "*Maintaining Athletic Fields*" (*www.rce.rutgers.edu/pubs/pdfs/fs105.pdf*) details numerous cultural practices and management strategies that can lead to long-term success. A complete list of Rutgers Cooperative Research &

Extension Fact Sheets can be found at: *www.rce.rutgers.edu/pubs*. The Rutgers Cooperative Research & Extension web site also provides contact information for County offices and other resources.

Mention or display of a trademark, proprietary product, or firm in text or figures does not constitute an endorsement by Rutgers Cooperative Research & Extension and does not imply approval to the exclusion of other suitable products or firms.

Desktop publishing by Rutgers' Cook College Resource Center

Published: August 2005

RUTGERS COOPERATIVE RESEARCH & EXTENSION
N.J. AGRICULTURAL EXPERIMENT STATION
RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY
NEW BRUNSWICK

Distributed in cooperation with U.S. Department of Agriculture in furtherance of the Acts of Congress on May 8 and June 30, 1914. Rutgers Cooperative Research & Extension works in agriculture, family and community health sciences, and 4-H youth development. Dr. Karyn Malinowski, Director of Extension. Rutgers Cooperative Research & Extension provides information and educational services to all people without regard to race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Rutgers Cooperative Research & Extension is an Equal Opportunity Program Provider and Employer.