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Building and Maintaining Soccer Fields in Indiana

Zac Reicher, Glenn Hardebeck and Clark Throssell
Purdue University Turfgrass Specialists

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Introduction

Soccer fields are the toughest of all turf areas to manage. Season-long traffic in all types of weather can literally destroy a field, plus the playing schedule rarely allows for aggressive turf management practices that are absolutely essential to keep grass alive. Soccer fields must be constructed and managed properly to provide adequate turf, while minimizing the chance of injury to players. This booklet highlights several principles of construction and maintenance to help produce a soccer field with good playability and emphasis on player safety.

Construction

Scheduling

When planning construction of any turf area, the optimum target completion date is August 1. This is because mid-August is the best time to seed cool-season turfgrasses like Kentucky bluegrass, which is the preferred grass to use for soccer fields throughout IN. Therefore, when planning construction, work backwards from mid-August, allowing ample time for grading, settling, installation of irrigation and drainage, etc. to determine the start date. If seeding occurs in mid-August when growing conditions are exceptional, and irrigation is supplied, the fields will normally be usable within 12 months after seeding. On the other hand, if seeding occurs at any other time of the year, it could take 18 months or longer before the field is ready for play.

Area Needed

Regulation size soccer fields are 147 to 295 ft wide (45 to 90 meters) and 295 to 393 ft long (90 to 120 meters). Fields for youth play can be smaller. When building soccer fields, it is important to plan extra fields to rotate play allowing turf to recover from damage. Another alternative is to make fields and surrounds large enough with borders to rotate the direction of play temporarily. For example, if a field runs north-south, allow enough space to rotate the field 90 degrees, creating two parallel fields that run east-west. This strategy spreads out turf wear on the heavy use areas like goal mouths and sidelines. Dedicated practice areas and parking should also be taken into consideration when planning soccer field complexes

Types of Fields

The three basic construction types are *native* soil fields made of existing soil or topsoil brought on to the site, *modified* soils where the existing soil is modified with amendments such as sand or peat, and *soilless* fields which are essentially 100% sand. The most common type of field is the native soil field. Rarely are modified soil fields built in Indiana because it will usually take at least 80% by volume of amendment to improve the native soil. Soilless fields are normally restricted to professional or university settings. Modified and soilless fields are difficult and expensive to build. Therefore, if you are considering a modified or soilless field, contact the information sources listed at the end of this booklet. The rest of this booklet describes construction and maintenance of native soil fields.

Grading and Drainage

It is critical to establish adequate surface drainage on a soccer field, or any other athletic field. Without proper surface drainage, depressions will gradually develop that will hold water, make it difficult to maintain turf, and possibly risk injury to players. Though most coaches and players prefer to have a perfectly flat field, this is only possible with a very expensive soilless field. A 2% slope is preferred on most turf areas, but a 1% slope is acceptable on native soil fields given play considerations. For native soil fields, it is imperative to achieve a 1% slope from the center of the field to both sidelines. This will make a crown from 9 to 18 inches at the center of the field depending on the width. A less desirable alternative is to slope the field from one sideline to the other at a 1 to 2% grade. This will provide a “flat” field and allow surface drainage off the field, but is not as efficient as moving water from a

field crowned in the center. Many will consider substituting subsurface drain tile lines for surface drainage. This is not recommended because water can be removed from a field more rapidly by surface drainage and will allow play within hours after a rain. Subsurface drainage is much slower and water will move off a field only within days or weeks after a rain. However, subsurface tile lines with open surface grates are important to install at the edge of a field to collect the surface drainage from the field (Figure 1).

The initial step in grading a soccer field is to remove the topsoil and stockpile it out of the way. The second step is to establish the subgrade using subsoil which will conform to the final grade. Therefore, the subgrade should be created with a crown running the length of the center of the field and sloping off at 1% to both sidelines. When moving large amounts of soil, account for about 15% settling on fine textured soils and less for coarse soils. In other words, if a foot of fine textured soil is moved to create the subgrade, that soil will settle about 1.5 to 2 inches.

Common Mistakes in Soccer Field Construction

1. Allowing inadequate time for construction in order to seed by mid-August.
2. Planning too little time between seeding and use to allow for turf establishment.
3. Not planning proper surface drainage.
4. Not including in-ground irrigation.
5. Not planning for adequate maintenance following construction.

After the subgrade is allowed to settle or is compacted, topsoil should be brought in over the rough grade. Ideally, four to six inches of topsoil is needed for optimum turf performance. After the topsoil is replaced, tile drainage with risers and/or catch basins should be installed on the sidelines of the field. In-ground irrigation should also be installed at this time. Though in-ground irrigation is relatively expensive to install, it is practically required to maintain playable soccer fields in Indiana. After drainage and irrigation installation, the topsoil will usually need to be tilled to break up clods and to create a uniform seedbed. Avoid tilling soils that are too wet because it will smear the soil and decrease drainage. Overly aggressive

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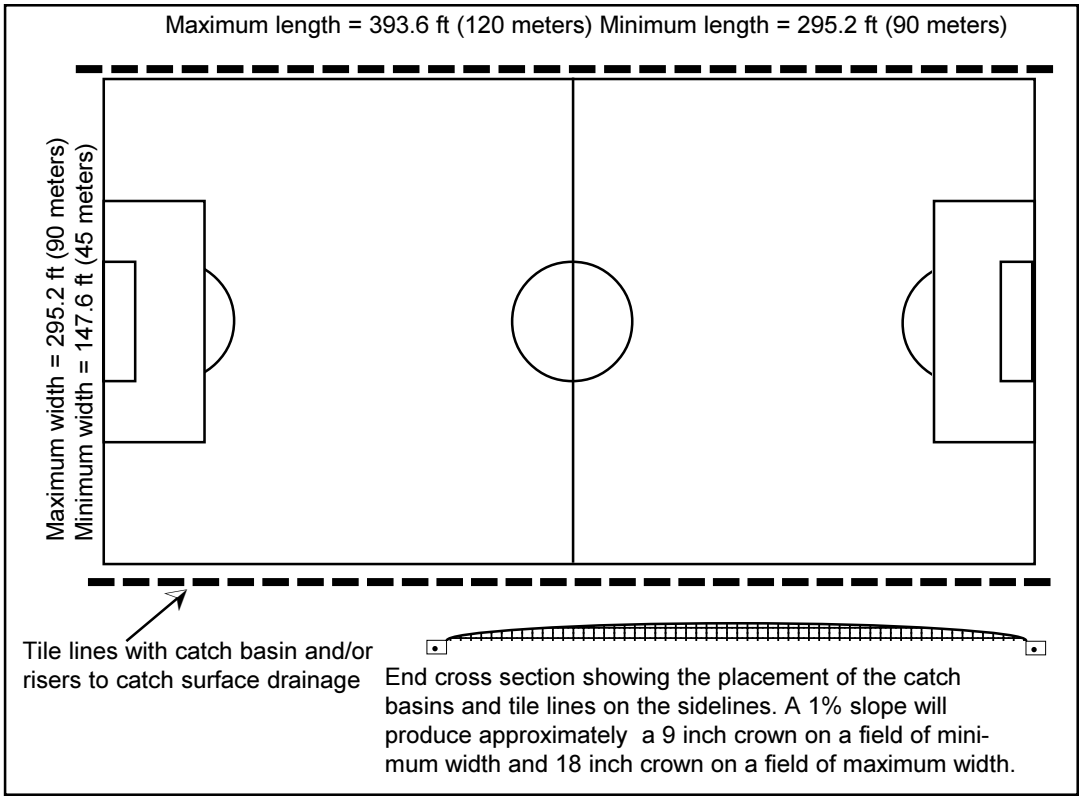
Figure 1. Dimensions and drainage plans for soccer fields.



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tilling should also be avoided because it will create a fluffy and fine particled soil that is prone to compaction and poor drainage and aeration. Inclusion of soil amendments during tillage provide marginal effects and thus generally are not recommended.

Prior to final grading, allow adequate time for soil to settle to avoid uneven turf later. Irrigation or rainfall will accelerate settling. During this time, a soil test should be taken from the site which will determine fertilizer recommendations for the area. Correct any deficiencies in nutrients or pH by following the recommendations on the soil test report. Final grading follows tilling and serves to smooth and level the surface. Hand rakes, sand trap rakes, or other tools are used to establish the seeding surface. A final shallow rakingshould occur immediately before seeding to prepare a good seed bed. After the seedbed is prepared, apply a starter fertilizer (high in P) at the rate of 1.5 lbs. P_2O_5/1000 ft^2. Starter fertilizer will help to promote rooting and establishment.

Establishment

Selecting a Grass Species

Kentucky bluegrass is the preferred species for most soccer fields in Indiana. Though slow to germinate and establish, Kentucky bluegrass has the best combination of wear resistance and recuperative ability of grasses adapted to Indiana. When establishing a soccer field, 100% Kentucky bluegrass blend containing three or four cultivars should be used. *At establishment, it is extremely important to achieve the highest percentage possible of Kentucky bluegrass in the stand, because it is the last chance to efficiently establish bluegrass in a soccer field.* Acceptable cultivars are listed in Table 1. Perennial ryegrass is sometimes included with Kentucky bluegrass in a seed mix at establishment, but perennial ryegrass is very susceptible to many diseases in Indiana and is not very heat tolerant. If you must include perennial ryegrass in the establishment mix, avoid seed lots with more than 10% perennial ryegrass by weight.

Table 1. Kentucky bluegrass cultivars for sports applications.

A-34 (Bensun)	Bristol	Nassau
Able I	Brunswick	P104
Adelphi	Cheri	Parade
America	Eclipse	Plantini
Aspen	Glade	Ram I
Baron	Indigo	Rugby
Barsweet	Limousine	Sydsport
Blacksburg	Majestic	Touchdown
Bonnieblue	Midnight	Unique
		Victa

Tall fescue is generally not recommended for athletic fields even though it is exceptionally drought and wear tolerant. Tall fescue is not recommended because it requires 18 to 24 months to establish before it can tolerate traffic, and it can become uneven and "clumpy" with extended heavy traffic. Tall fescue is only recommended for lightly trafficked soccer fields without irrigation and when there can be 18 to 24 months between seeding and use.

In the southern-most tier of counties in Indiana, bermudagrass is gaining popularity in athletic fields. Bermudagrass is a warm season grass that grows very actively from May until September in southern Indiana, but is dormant from late September through May. This is important because bermudagrass cannot withstand typical soccer traffic when it is dormant. Thus bermudagrass is only recommended on fields that receive only summer play and no play from September through May. Additionally, bermudagrass is susceptible to winterkill which may occasionally kill large areas of bermudagrass over the winter. If a soccer complex in southern Indiana has the luxury of many fields that can be rotated in and out of play, one or two bermudagrass fields would work well for summer play, while the bluegrass fields could be used for play during the remainder of the year.

Bermudagrass is not widely available by seed and thus will probably need establishment by sprigging or sodding. The only two recommended varieties of bermudagrass for southern Indiana are

Quickstand and Midlawn. If a bermudagrass field is planned, it should be established in early June, thus construction schedules will be different than a Kentucky bluegrass field. Bermudagrass maintenance needs are very different than those needed for cool season grasses like Kentucky bluegrass or perennial ryegrass.

Buying Good Seed

It is important to purchase high quality grass seed for any turf area, but it is especially important for soccer fields. High quality seed will probably be some of the most expensive seed available. However, the cost of seed is minuscule compared to the amount of money spent on maintaining the soccer field for the next 20 years or the lifetime of the field. The best way to purchase high quality grass seed is to contact a reputable company who has experience providing seed for soccer fields. Additionally, the ability to understand seed labels is critical when selecting seed to determine the quality. Table 2 lists the preferred ranges of items found on the label of a quality seed lot. Be sure to save the label from the seed in case you need to purchase more seed later or a problem with the seed lot develops after seeding.

Time of Seeding

Fall Seeding

As mentioned previously, the best time of year to seed a soccer field is in the late summer to early fall. Adequate soil moisture, warm soil, and limited weed pressure allow for excellent seedling growth. The more time that the field can establish before summer, the better. Between August 15 and September 15 is optimum seeding time in the northern half of Indiana; from September 1 to September 30 is optimum in the southern half of Indiana. It is critical to seed as early as possible within these windows. Even when seeding within these windows, waiting one week later to seed may mean the stand will take two to four additional weeks to mature. Establishment in the spring is possible but not as effective as fall seeding.

Table 2. Preferred ranges for items on the label of a good quality seed lot.

Item	Preferred Range
Purity	>90%
Germination	>80%
Crop	<0.5%
Weed	<0.3%
Noxious Weed	0
Inert	<8%
Date Tested	last 9 months

Seeding in Spring or Winter

Seeding in the spring is possible, but only if an automatic irrigation system is in place to provide adequate water for the seedlings through the first summer. It is important to seed as early in the spring as possible to maximize the competition of turfgrass over crabgrass. Dormant (winter) seeding or early April seeding is preferred. Dormant seeding occurs when seed lies dormant until the soil temperatures warm in April or May. Depending on your location in Indiana, dormant seeding can be done as early as Thanksgiving and as late as March. The benefit of dormant seeding is that as the soil heaves and cracks during the winter, crevices (honeycombs) are created for the seeds which create ideal germination conditions. Additionally, dormant seeding is easier to schedule than spring seeding, because spring rains make it difficult to seed after March in Indiana. Though seed-soil contact is important regardless of seeding date, it is especially important when dormant or spring seeding. Irrigate often as soon as temperatures favor germination (soil temperatures above 55°F). As root systems develop, gradually reduce frequency but increase duration of irrigation. Continue irrigation throughout the summer until an adequate root system is established.

Seeding

Seed should be applied using a drop spreader, because rotary spreaders do not disperse the seed uniformly. However, there are no spreader calibration guides for turfgrass seed. The easiest way to apply seed uniformly is to set the spreader adjustment very low, sow one half of the seed in one direction, and then sow the other half at right angles to the first direc-

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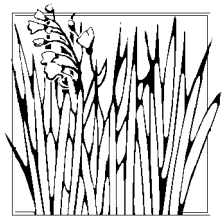

tion of seeding. It might take three or more passes over the field in a single direction, but it is well worth the time to get a uniform seeding. Hydroseeding can be used where seed is combined with paper-based mulch and sprayed onto the field. Though this is more expensive than traditional drop seeding, it delivers excellent results with good germination and the added benefits of mulch. Contact a local reputable landscaper for hydroseeding. Whether drop seeding or hydroseeding, use a seeding rate of 2 lbs/1000 ft^2 or 87 lbs/Acre for Kentucky bluegrass and 6-7 lbs/1000 ft^2 or 260-305 lbs/A for tall fescue. If you must include perennial ryegrass in the seed lot with Kentucky bluegrass, it should contain a maximum of 10% perennial ryegrass by weight and the mix should be seeded at 4 lbs/1000 ft^2 or 154 lbs/A.

Mulching

Mulching is generally not recommended for an area as large as a soccer field. However, since mulch conserves water, it is important to mulch soccer fields that cannot be watered two to four times daily during establishment. One bale of clean (weed-free) straw per thousand square feet will give a light covering that will not have to be removed after germination. Oat or wheat straw is strongly preferred over hay or soybean stubble. Do not apply too much mulch which will shade seedlings and have to be raked off later. Apply the mulch very lightly so you can still see approximately 50% of the soil through the mulch layer.

Watering

Seedlings are very susceptible to drying out, and the seedbed should not be allowed to dry. A newly-seeded soccer field will need to be irrigated two to four times daily depending on the weather. This is why automatic irrigation is extremely important. Enough water should be applied during each irrigation to moisten the top one-half to two inches of the soil profile, but avoid over-watering and saturating the area. Once the seedlings are two inches high, gradually reduce the frequency of irrigation and water more deeply. After the turf has been mowed two or three times, deep and infrequent irrigation to the depth of the root system is most effective.

Mowing

Mowing a new field will encourage the turf to fill-in quickly. Mowing should begin when the first few seedlings are tall enough to mow. You may only mow 10% of the plants in the first mowing, 20-30% of the plants in the second mowing, and so on. Most people wait too long to mow a newly seeded field, so mow early and often. Mow Kentucky bluegrass, and perennial rye at 2.0-2.5 inches and tall fescue at 2.5-3.0 inches. As always, never remove more than 1/3 of the grass blade at any one mowing.

Fertilizing

New seedlings have poorly developed root systems, and thus they cannot effectively absorb nutrients from the soil. Therefore, it is important to fertilize frequently after seeding to encourage establishment. Use a fertilizer containing N, P_2O_5 and K_2O in approximately a 4:1:2 ratio and apply 0.75 to 1.0 lb N/1000 ft^2 four to six weeks after germination and again eight to ten weeks after germination. Assuming seeding in mid-August, these applications would be mid-to-late September and again mid-to-late October. If dormant or spring seeding, apply 0.75 lbs N/1000 ft^2 four to six weeks, eight to ten weeks and again 12-14 weeks after germination.

Controlling Weeds

There is little weed pressure in the fall so weed control may not be needed for fall seedings. If broadleaf weeds such as clover and dandelion become a problem later in the fall, they can be easily controlled with a broadleaf herbicide application in October or November, after the third or fourth mowing. Annual grasses such as crabgrass can be easily controlled the first year with preemergence herbicides applied in the spring. In seedings made very late in fall, winter, or spring and the field is not fully established by spring, avoid applying a preemergence herbicide in early spring because it may damage late-developing seedlings. In this case, consider using a postemergence crabgrass herbicide later in

summer to control crabgrass.

Annual Maintenance

Controlling Traffic

Constant play on soccer fields will cause the turf to deteriorate and become unplayable and possibly dangerous to the athletes. Strict traffic management is the most effective tool in maintaining playability of soccer fields. Rotate play to schedule maintenance such as aerification and overseeding to limit turf damage and aid in recovery. Consider preventing play for three or more growing months each field depending on the time of year, amount of play, and extent of damage. Keep strict practice areas to limit damage on game fields. Consider movable goals, benches, bleachers, and fences to help further limit damage.

Mowing

Mowing is important to maintain the health, playability, and aesthetics of a soccer field. Mowing height of a Kentucky bluegrass soccer field should be approximately 2.0-2.5 inches, 0.75 inches for bermudagrass, and 2.5-3.0 inches for tall fescue. Mowing lower than these heights on most fields will put added stress on the plants and will decrease vigor of the plants and playability over the long term. Mowing below the optimum height restricts root growth, favors weeds, and increases susceptibility to damage from insects, disease, drought, and traffic.

Mowing frequency depends on how fast the grass is growing. Some fields may need mowing two or three times per week during spring and fall and only once every two weeks during summer. Mow frequently enough so as not to remove more than 1/3 of the leaf blade in a single mowing. For instance, if you are mowing at two inches, mow before the grass reaches three inches tall. If the grass has grown too tall, raise the mowing height and gradually lower it back to the original height over a few mowings. Avoid mowing during midday when temperatures are above 90° and the soil is dry because you may damage the turf. If you must mow during a hot and dry period, wait until temperatures moderate in the early morning or late evening.

Rotary mowers can be used on soccer fields mowed at two inches or higher. Most rotary mowers do not cut well at mowing heights less than two inches. Reel type mowers, on the other hand, mow best at two inches and lower. Regardless of the mower type, mower blades must be sharp and may need sharpening four to six times a year. A sharp blade results in a cleaner and healthier cut, leaving a more attractive and healthy field.

Clipping removal is generally not recommended on most turfgrass areas including soccer fields. Clippings do not cause thatch, and returning clippings will recycle valuable nutrients to the soil thereby reducing fertilizer requirements.

Aerifying

Aerification is the mechanical removal of soil cores and may be the most important turf management practice on soccer fields. Aerification relieves soil compaction, improves water and air movement into the soil, increases rooting, and greatly improves turfgrass health. Aerification is most beneficial in compacted areas with intense traffic such as goal mouths, the centers of fields, and sideline areas. Whenever aerification is done on a soccer field, it should be combined with seeding to help maintain dense turf. This will be discussed more in the overseeding section.

Aerification is most beneficial when the largest tines or spoons available are used, penetration is 2 to 4 inches deep, and when 20 to 40 holes are punched per square foot. Aerifiers with reciprocating arms are the most effective. Aerifiers that roll behind tractors are less effective because they do not penetrate deep enough nor punch enough holes per square foot. Most aerifying machines available at rental agencies may not punch enough holes per square foot on a single pass, thus multiple passes will be needed to achieve the 20 to 40 holes/ft^2. Cores can be broken up and dispersed following aerification with a dragmat.

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Practices such as slicing or spiking remove no soil and are not considered aerification. The purchase of a large reciprocating arm aerifier should be included in the budget because aerification will be needed often. There are professional aerification services that can be hired to aerify athletic fields providing a viable alternative to purchasing your own aerifier.

Aerification should be performed as often as possible on a soccer field and should be done preferably when the turf is actively growing. However, if playing schedules do not allow for aerification during the season, aerifying at any time of the year on soccer fields better than not aerifying at all. Kentucky bluegrass or tall fescue should be aerified at least once in the fall (September) and once in the spring (April). Goal mouths and other high traffic areas can also be aerified during the season when there is a break in play. Bermudagrass should be aerified at least once in June or July when it is actively growing.

Irrigating

To maintain a healthy, actively growing turf capable of recovery from damage, it is essential to water a soccer field during dry periods. This is especially important on a soccer field that receives regular overseeding or sprigging because seedlings are present in the field almost all year long. Seedlings cannot withstand moisture stress because they do not have a well-developed root system capable of extracting water from a large area in the soil. Bermudagrass fields generally have much lower water requirements than Kentucky bluegrass fields. However, ample water is needed to encourage recovery and establishment of new Bermudagrass sprigs. The same principles for irrigating cool season grasses hold true when irrigating warm season grasses.

The frequency of watering will vary from site to site and should be determined by the appearance of the turf. This can be determined because the first signs of water stress in a turfgrass stand are a bluish-green color, and footprints remain in the turf after walking across it. Ideally, the turf should be watered at this point. As the degree of water stress increases, the turf will wilt and develop a grayish-green color. Turf that has wilted should be watered without delay. Wilted turf will recover very rapidly following watering. Severe drought stress will cause the turf plants to cease growing, and the leaves will turn brown and possibly die. If soccer fields are allowed to wilt or turn brown, do not allow play on the fields until they can be irrigated and the turf recovers. Though this might take up to two weeks, it will prevent severe damage that will result from traffic on wilted or dormant turf.

Most fields in Indiana will need from 1 to 1-1/2 inches of water per week depending on weather, soil type, etc. It is best to apply this amount of water in a single, thorough soaking, or two equal applications of water three to four days apart rather than in light irrigations every day. The soil should be wetted to the depth of the deepest root.

Schedule irrigation as to not interfere with play and to allow ample infiltration and drying prior to use. The ideal time to irrigate a soccer field is from 4:00 to 8:00 a.m. At this time, water pressure is usually high, there is little distortion of the watering pattern by wind, the amount of water lost to evaporation is negligible, and the field will dry by the time it is used later in the day. The second best time to water is from 8:00 to 12:00 p.m. Usually, distortion from the wind is not a problem at this time and loss from evaporation is slight. A major problem may be lack of water pressure for those using municipal water systems. A potential problem caused by watering in the early evening hours may be greater incidence of disease. This problem can be reduced by watering only when the turf needs water and by watering infrequently but deeply. Watering an established turf during midday is not very effective. A large amount of water is lost through evaporation, making it difficult to thoroughly wet the soil. Although not recommended, midday watering does not cause the turf to burn as once thought.

Table 3. Nitrogen forms found in turf fertilizers.

Quick Release N	Slow Release N
Urea	Sulfur Coated Urea (SCU)
Ammoniacal N (NH_4)	Polymer Coated Urea
Ammonium Nitrate (NH_3NO_3)	Methylene Ureas
	Natural Organics

Fertilizing

Soccer fields need to be fertilized to maintain color, density, and vigor. Soccer fields need to be fertilized slightly more than other turf areas to encourage growth and overcome the constant wear and tear. Fertilizer needs may vary due to:

- Weather: A rainy summer will stimulate growth and will usually necessitate more annual fertilizer than a dry summer. The same holds true for an irrigated field versus an unirrigated field.
- Soil type: Turf grown on a very sandy or a very heavy clay soil will need more fertilizer than turf grown on a silt loam soil. Soil type and pH will have a large effect on the amount of phosphorus and potassium that needs to be applied.
- Age and quality of existing field: A new field will need more fertilizer for the first few years to enhance density. Improving a neglected or thin field that needs significant overseeding or sprigging may also require more annual fertilizer for the first few years.
- Species: Perennial ryegrass needs slightly more fertilizer than Kentucky bluegrass. This additional 0.5 to 0.75 lbs N/1000 ft^2 should be applied in the late spring or early summer to help combat disease problems.

Fertilizers

All fertilizers will have a series of three numbers displayed prominently on the label. These numbers represent the percentage by weight of nitrogen, phosphorus (as P_2O_5), and potassium (as K_2O). For instance, a 24-4-8 fertilizer will have 24% N, 4% P_2O_5, and 8% K_2O. Though all three elements are important in maintaining a healthy turf stand, N will cause the greatest response. Because of this, most fertilizer recommendations for fields are listed as lb. N/1000 ft^2. Nitrogen fertilizers come in two basic forms: quick release (soluble) nitrogen and slow release (insoluble) nitrogen. Quick release nitrogen normally causes a response in a week or less, whereas slow release nitrogen will cause a response in three to 10 weeks or more. Quick release nitrogen is inexpensive and may burn leaf blades if applied improperly. Slow release forms tend to be more expensive, but will rarely burn leaf blades even when applied at temperatures above 85°. Both N forms can and should be used on fields. Examples of slow and quick release N forms are listed in Table 3. Both forms of N are often blended in one fertilizer bag. This is advantageous because the quick release N gives a response shortly after application and the slow release N results in a more gradual and longer response.

Fertilizing with phosphorus and potassium is also important in maintaining a healthy field. The best way to determine how much phosphorus and potassium to apply annually is to follow the recommendations of a soil test. In lieu of a soil test, a general recommendation is to apply 1/4 as much phosphorus and 1/3 as much potassium as nitrogen. For instance, if you apply 4 pounds N/1000 ft^2 per year, you should apply 1 lb P_2O_5/1000 ft^2 phosphorus and 3 lb K_2O/1000 ft^2 per 1000 ft^2 per year.

On Kentucky bluegrass or tall fescue fields, it is best to fertilize lightly in spring and early summer, little to none in summer, and heavy in fall. A heavy fall fertilization program will produce the healthiest turf throughout the year. Applying high rates of N in spring and summer stimulates excess leaf growth at the expense of root growth.

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Table 4. Fertilization programs for soccer fields containing Kentucky bluegrass, perennial ryegrass and/or tall fescue.

Date	lb. N/1000 ft^2	Maximum	Program Standard	Minimum	Nitrogen Release Form
Sep. (fall)	1.0	X	X	X	Slow/Quick
Oct.	1.0	X	X		Slow/Quick
Nov. 1-15 (late fall)	1.0	X	X	X	Quick
May 15-June 1	1.0	X	X	X	Slow
July 15-30	0.75	X			Slow

Not only does this force frequent mowing, it reduces turf quality during the summer. High rates of spring and summer N can also stimulate disease, weed, and insect activity. On bermudagrass soccer fields, it is better to fertilize in May and June with no fertilizer applied in the fall, near or after the onset of dormancy. However, potassium should be applied just prior to bermudagrass dormancy at 2.0 lbs K_2O/ 1000 ft^2 with muriate of potash (0-0-60) to help improve winter hardiness.

Tables 4 and 5 list the Purdue recommendations for soccer fertilization programs. The maximum program is to overcome damage in heavily-used soccer fields with adequate budgets for irrigation, mowing, and fertilization. The standard program is for most soccer fields in Indiana and the minimum program would be for soccer fields that are seldomly-used fields with no irrigation.

Apply fertilizer uniformly over the field. It is best to adjust the spreader setting for the half rate of fertilizer and apply in two directions perpendicular to each other. For rotary spreaders, apply the fertilizer so the wheel is at the edge of the pattern from the previous pass. Improper spreading of fertilizer will result in "streaking", the alternate dark- and light-green stripes in the field. Irrigation or rain following fertilization is important to move nitrogen off the leaf blades and into the soil. Some fertilizer/herbicide combination products cannot be watered-in, so be sure to read the label instructions. Avoid applying fertilizer to drought-stressed or dormant turf, or when temperatures are over 80^{o}F.

Overseeding

With the constant traffic on soccer fields, it is important to overseed regularly during the year to maintain density. The optimum time to overseed cool-season turfgrasses is in August and September in Indiana. However, for the highest quality soccer field, overseeding can and should be done at any time of the year as long as there is adequate irrigation to provide for germination and establishment. The species used for overseeding depends largely if there will be continuous play on the field within six weeks of seeding. If there will be traffic on the field, a mix of 20 to 50% perennial ryegrass and 50 to 80 % Kentucky bluegrass should be used. If little or no traffic is expected, then 100% Kentucky bluegrass should be used. Perennial ryegrass works better in the short term because it germinates quickly, is fairly traffic tolerant as a seedling, and provides quick recovery of the area. Kentucky bluegrass germinates more slowly, but is better for the long term because it but produces a more disease tolerant turf with better wear recovery. When overseeding, apply 4 to 6 lbs/1000

Table 5. Fertilization programs for Bermudagrass soccer fields.

Date	Rate/1000 ft^2	Maximum	Program Standard	Minimum	Fertilizer
May 1 -15	1.5 lbs N	X	X	X	Urea (46-0-0)
June 1-15	1.5 lbs N	X	X		Urea (46-0-0)
September	2.0 lbs K_2O	X			Muriate of potash (0-0-60)

ft^2 if the mix contains perennial ryegrass and 2 to 3 lbs/1000 ft^2 if the seed is 100% Kentucky bluegrass. Overseeding a tall fescue field should be done with seed containing 100% tall fescue at 5 to 6 lbs/ 1000 ft^2.

The first step in overseeding is to apply a starter fertilizer (high in phosphorus) over the entire field at 1.5 lbs P_2O_5/1000 ft^2. Then aerify the field, punching at least 20 to 40 holes/ft^2 with the largest hollow tines available. This will increase the seed-soil contact, improving germination and rate of establishment. You can rarely over aerify at this time, so make many passes over the field concentrating especially on the goal mouths and the center of the field. A power raking at this time will also help to increase the seed-soil contact and break up the aerification cores. Apply the seed to the field with either a dropseeder or a power overseeder, which is a machine that will drop the seeds into small grooves that it cuts into the soil. Try to make two to four passes over the field in different directions with either the dropseeder or the power overseeder to insure a uniform seeding. After seeding, water the newly-seeded area three to four times daily with light irrigation. Continue to mow frequently to limit shade and competition from the established turf. Six weeks after germination, apply 0.75 to 1.0 lb N/1000 ft^2 with a fertilizer containing N, P_2O_5 and K_2O. Avoid applying any herbicides to the area prior to seeding or for at least 6 weeks after seeding, but check the label for the specific instructions for each product.

Overseeding bermudagrass is currently not possible because bermudagrass seed is unavailable. Bermudgrass sprigs should be used to repair damage on a bermudagrass field. After the bermudgrass has greened-up, aggressively hand- or power rake the area to be repaired to stir the soil and allow for good sprig-soil contact. Use a power rake on a healthy portion of the field to sever bermudagrass sprigs. Rake up the sprigs and spread them in the damaged area. Tamp or roll the area to push the sprigs into contact with the soil. Keep the sprigs well-watered until they germinate, and then follow the previous instructions for fertilization.

Controlling Pests

Very few pests are problematic in soccer fields in Indiana. Most pests can be minimized, if not eliminated, by proper fertilizing, watering, aerifying, and mowing. However, pesticides may be needed in certain cases. The labels on pesticides will normally state when traffic can be allowed back into an area following an application. As a rule of thumb, once a pesticide is allowed to dry on the leaves, it is very improbable that it can be removed by contact from soccer players. To be extra cautious, it would be wise to limit traffic on a field within 24 hours after any pesticide application. Always follow the label instructions when using any pesticide.

The labels on most herbicides indicate that they cannot be used before seeding and sprigging or on seedling turf. Thus herbicide use is often restricted because seedlings are usually present on soccer fields. Because of this, the strongest weapon against weeds is a dense, healthy turf. Since seeding may occur regularly throughout a season, preemergence annual grass herbicides should rarely be used to control crabgrass. Preemergence herbicides will dramatically decrease establishment of seedlings. Instead, use postemergence annual grass herbicides such as MSMA (Daconate 6), dithiopyr (Dimension), or fenoxaprop (Acclaim) to control crabgrass. Broadleaf weeds such as clover and dandelion can be controlled with broadleaf herbicide applications in the spring or fall, but seeding cannot occur after this application until a heavy rain or thorough irrigation occurs. Broadleaf weed herbicides should not be applied over the top of seedlings until the seedlings are large enough to mow two or three times, which might be a month or more depending on seeding date. *Poa annua* is becoming a problem on some athletic fields, but since control is extremely difficult, it should be attempted only on high-budget fields.

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Always follow label instructions when using any herbicide for specific uses, rates, and flexibility of use around seeding.

Turfgrass diseases are generally not a problem on soccer fields. Rust, red thread, and dollar spot may cause problems on fields low in nitrogen. Generally, increasing the annual rate of N should limit these diseases in the future. Brown patch and pythium are two diseases that may cause extensive damage in July and August in fields with a high percentage of perennial ryegrass and are heavily fertilized. Preventative fungicide schedules should be used only on fields with a history of disease problems.

Insects may become a problem on some athletic fields containing cool season grasses. The type and cause of the problem varies widely among locations, but white grubs probably cause most damage of the insect pests. White grub damage is generally seen in late August and September when patches of turf wither and dry. White grubs can be controlled through a preventative insecticide application made in late June or July, depending on the product used. However, preventative white grub applications probably are not needed unless the field has a history of white grub damage.

Weeds are usually the only pests in bermudagrass fields. Controlling weeds in bermudgrass fields is best done with an application of glyphosate (Roundup) in December or January when the bermudagrass is dormant. Diseases and white grubs are not problems in bermudagrass fields.

Thatch Control

Thatch is a tightly intermingled, organic layer of dead and living shoots, stems, and roots that accumulate just above the soil surface. Thatch accumulation is due to either over-fertilization, over-watering, and/or soil compaction. Soccer fields rarely develop a thatch layer because of the constant wear and tear on the grass. Thus, thatch control is normally not necessary on soccer fields, and the regular aerification practices should suffice as a thatch control method.

Topdressing

Topdressing is the practice of spreading a thin layer of sand and/or soil over the field which is then dragged or brushed into the turf. Topdressing is helpful in smoothing a field and can help improve establishment when used after seeding. Topdressing with sand following aerification may help to change the soil profile over many, many years. Time and money should only be spent on topdressing after other basic turf management practices are done and perfected. Therefore, topdressing is reserved only for the high-budget soccer fields.

Other Sources of Information

SportsTurf Managers Association (STMA)
P.O. Box 3480, Omaha, NE 68130 800-323-3875

Purdue University Turfgrass Science Program WWW Page
http://www.agry.purdue.edu/turf

Athletic Fields - Specification Outline, Construction, and Maintenance.
Agricultural Sciences Distribution Center, Agricultural Admin. Bldg., University Park, PA 16802.

United States Soccer Federation
1801-1811 S. Prairie Ave, Chicago, IL 60616, 312-808-1300, http://www.us-soccer.com

United States Youth Soccer
899 Presidential Dr # 117, Richardson, TX 75081-2964, 800-476-2237

Thanks to Chuck Stephenson, Monroe County Parks, and Tom Voigt, University of Illinois, for reviewing this publication.

Table 6. Management calendar for Indiana soccer fields containing Kentucky bluegrass, perennial ryegrass, or tall fescue.

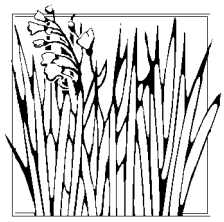
Month	Maintenance Level			Notes
	Low	Medium	High	
March	Overseed if unable to fall or dormant seed	Overseed if unable to fall or dormant seed	Overseed if unable to fall or dormant seed	Kentucky bluegrass is preferred unless tall fescue is the dominant species on the field
April		Begin aerification and overseeding	Begin aerification and overseeding	Use a mix containing perennial ryegrass if the field is in use
May	Apply 1.0 lb N/1000 ft^2 after spring growth flush Control broadleaf weeds if needed	Apply 1.0 lb N/1000 ft^2 after spring growth flush Control broadleaf weeds if needed	Apply 1.0 lb N/1000 ft^2 after spring growth flush Control broadleaf weeds if needed Continue aerification and overseeding when possible	Use fertilizer with 50% or more slow release N Check label for seeding limitations Use a mix containing perennial ryegrass if the field is in use
June	Monitor annual grassy weeds and control if necessary	Monitor annual grassy weeds and control if necessary Irrigate as needed	Monitor annual grassy weeds and control if necessary Irrigate as needed	Check label for seeding limitations
July	Control white grubs if history dictates	Control white grubs if history dictates Irrigate as needed	Control white grubs if history dictates Apply 0.75 lb N/1000 ft^2 Irrigate as needed Monitor disease pressure and control if necessary	Use fertilizer with 50% or more slow release N

Table 6. Management calendar for Indiana soccer fields containing Kentucky bluegrass, perennial ryegrass, or tall fescue.

Month	Maintenance Level			Notes
	Low	Medium	High	
August		Irrigate as needed	Irrigate as needed Monitor disease pressure and control if necessary	
September	Apply 1.0 lb N/1000 ft^2 Aerification and overseeding if schedule permits	Apply 1.0 lb N/1000 ft^2 Aerification and overseeding if if schedule permits	Apply 1.0 lb N/1000 ft^2 Aerification and overseeding if schedule permits	Use fertilizer with 30-50% slow release N Use a mix containing perennial ryegrass if the field is in use, 100% Kentucky bluegrass if no traffic is expected, or 100% tall fescue if tall fescue is the dominant species in the field
October	Optimum time to control broadleaf weeds	Optimum time to control broadleaf weeds Apply 1.0 lb N/1000 ft^2	Optimum time to control broadleaf weeds Apply 1.0 lb N/1000 ft^2 Consider aerification and overseeding if schedule permits	Check label for seeding limitations Use fertilizer with 30-50% slow release N Use 100% Kentucky bluegrass if no traffic is expected or 100% tall fescue if tall fescue is the dominant species in the field
November	Apply 1.5 lb N/1000 ft^2 Aerify and dormant-seed following last game	Apply 1.0 lb N/1000 ft^2 Aerify and dormant-seed following last game	Apply 1.0 lb N/1000 ft^2 Aerify and dormant-seed following last game	Use fertilizer with 100% fast release N (urea) Use Kentucky bluegrass for overseeding

Table 7. Management calendar for Indiana soccer fields containing Bermudagrass.

Month	Maintenance Level			Notes
	Low	Medium	High	
April	Keep all traffic off field until bermudagrass greens-up and begins growing actively	Keep all traffic off field until bermudagrass greens-up and begins growing actively	Keep all traffic off field until bermudagrass greens-up and begins growing actively	
May	Apply 1.5 lbs N/1000 ft^2 after bermudagrass has greened-up	Apply 1.5 lbs N/1000 ft^2 after bermudagrass has greened-up	Apply 1.5 lbs N/1000 ft^2 after bermudagrass has greened-up	Use urea (46-0-0)
June	Monitor annual grassy weeds and control if necessary Resprig damaged areas Aerify if schedule permits	Monitor annual grassy weeds and control if necessary Resprig damaged areas Aerify if schedule permits Irrigate as needed Apply 1.5 lbs N/1000 ft^2	Monitor annual grassy weeds and control if necessary Resprig damaged areas Aerify if schedule permits Irrigate as needed Apply 1.5 lbs N/1000 ft^2	Check label for seeding limitations Use urea (46-0-0)
July		Irrigate as needed	Irrigate as needed Aerify if schedule permits	
August		Irrigate as needed	Irrigate as needed	
September			Apply 2.0 lb K_2O/1000 ft^2	Use muriate of potash (0-0-60)
October - April	Keep all traffic off field after Bermudagrass goes into dormancy	Keep all traffic off field after Bermudagrass goes into dormancy	Keep all traffic off field after Bermudagrass goes into dormancy	
December - February	Consider an application of glyphosate to control weeds	Consider an application of glyphosate to control weeds	Consider an application glyphosate to control weeds	Bermudagrass must be absolutely dormant



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