

*Guide To
No-Till TifEagle
Management*



TifEagle *The Ultimate
Ultradwarf Bermudagrass*

Tiff *for greens* **aaale**

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No-Till TifEagle Establishment and Management



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introduction

TifEagle -The Ultimate Ultradwarf

TifEagle has a number of unique advantages over traditional bermudagrass greens varieties, as well as many of the new ultradwarf varieties. When maintained at a cutting height of 0.125 inch (3.2mm), TifEagle produces a quality putting surface second to none. It exhibits very aggressive rhizomatous and stoloniferous growth habits, maintains superior color under cool conditions and provides an excellent putting surface during the winter season, with or without overseeding. In fact, many superintendents are reporting excellent results with painted TifEagle greens.

The No-Till Process and Golf Greens

No-till or minimum-till is not a new concept. The practice has been around for a number of years and has proven to be an excellent method for reducing production costs, preserving soil moisture, and reducing soil and nutrient loss for many crops. In recent years, a specialized “no-till process” has been successfully used on golf courses to hold down the costs associated with greens renovations. It basically involves applying Roundup® or methyl bromide to kill the existing grass and verticutting down to the stolon/rhizome/top-dressing interface to create a healthy seedbed, followed by a thorough clean-up of all debris. The final steps include aerification, topdressing and, of course, distribution of fresh new TifEagle sprigs.

Save Time, Money and Labor

For most golf courses, the no-till process offers a two-fold benefit. It significantly reduces down time and, when compared to conventional greens reconstruction, the savings are substantial. Bottom line, with no-till a new putting surface can be established much quicker with fewer inputs.



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evaluation

Green-by-Green Inspection and Evaluation

Yes, you can save time. Yes, you can save money. But are your greens candidates for no-till? The absolute best way to determine whether no-till will work for you is to conduct an individual inspection and evaluation of each of your greens. No-till may work for all of your greens or you may find that some of your greens require conventional renovation. From our experience, most golf course greens are good candidates for no-till re-grassing.

Who Should Evaluate Your Greens?

Inspections should be conducted by you and your personnel in concert with the greens committee and golf pro. Our authorized no-till TifEagle Grower/Installers also have trained staff who can assist in the evaluation process. Under ordinary conditions this will be at no expense or obligation to you, unless lab tests are required. Some facilities have contracted with a USGA Green Section agronomist, which is a little more expensive, but well worth the money.

How to Evaluate and Grade Your Existing Greens

First, identify existing situations or problems that lower the quality of your greens and create management challenges, either routinely or during specific times of the year. These problems can be categorized into secondary problems (symptoms) and primary problems or the fundamental causes of the deficiency. It is very important to identify the primary problems causing the secondary problems or symptoms. Most of these should be addressed and corrected prior to replanting the green. Remember, problems that do not relate to cultivar genetics most likely will continue to cause management difficulties and challenges, even after regrassing. Second, evaluate specific criteria for each green and determine if changes need to be made to provide optimum growing conditions for your new TifEagle and/or to improve the quality of play on the golf course.



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problems

Older Greens Are Susceptible

As Dr. Bob Carrow, professor of turfgrass science with the University of Georgia, points out, "Physical, chemical and biological soil conditions can all affect golf course greens. If you find problems in these areas on older greens, unless you take corrective action, those problems are going to persist and probably get worse. Minor organic matter buildup can usually be dealt with after you no-till, but no-till is by no means a magic bullet for most problems. Be wary of excessive organic matter buildup. Look for contouring problems, poor drainage, water-logging, standing water, dry spots, soft spots, layering, diseases, pests (especially nematodes), poor air movement, excessive wear, shade issues and high salt accumulations." Dr. Carrow and other experts recommend visual observation and, for specific problems, field and lab tests.



Correct These Problems Prior to No-Till Renovations

- > *Light and tree shade issues. You need a minimum of 8 to 10 hours of sun on bermudagrass greens. See appendix p.28.*
- > *Surface drainage problems, including water-collecting hollows. See appendix pp.29-30.*
- > *Internal drainage and root zone porosity problems. See appendix pp.30-31.*
- > *Irrigation coverage. You must have uniform water application.*
- > *Minor design changes to re-establish original green perimeter*
- > *If organic matter is high, but less than 5% in the surface 2-inches, core aeration and topdressing before regrassing coupled with routine core aeration after regrassing should be adequate. If organic matter is higher than 5%, you may need to remove more of the surface by vertical mowing. See appendix pp.32-34.*
- > *Restrictive layers in the soil profile and black layers should be addressed with extensive core aeration before regrassing. See appendix pp.35-37.*
- > *Nematodes. See appendix pp.38-39.*
- > *Greens speeds/cupping areas. See appendix p.40.*
- > *Water quality.*

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the process

Background

TifEagle is grown, inspected and sold under a rigorous set of rules and guidelines set up by the Georgia Seed Development Commission to promote on-going purity and uniformity. In fact, TifEagle is the only ultradwarf variety which has this kind of unbiased third-party oversight. This ensures that the TifEagle sprigs you receive are not contaminated with offtypes, which may occur in the Tifgreen/Tifdwarf family of cultivars. Research has shown that glyphosate alone, regardless of which new ultradwarf bermuda-grasses you plant, will not eliminate 100% of the existing plants on a golf green. The presence of variants in these ultradwarf greens, some of which are over 7 years old, does not appear to affect play, but if you or your members are concerned about absolute genetic uniformity and color consistency it is essential that you fumigate. Fumigation might also be necessary for insect and pest control.

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Surface Preparation

- > We recommend fumigation, but if you use glyphosate, treat with a minimum of two to three applications at a minimum of 21-30 day intervals. The herbicide should be applied at labeled rate and according to the manufacturer's directions. Allow at least 10 days after the last application before disturbing the surface to allow for maximum translocation within the plant.*
- > If you are using glyphosate, apply at least two to three feet into the green's collar.*
- > Verticut the greens and collars in a minimum of two directions (preferably three) down to the thatch/soil interface to remove as much of the thatch/mat layer as possible.*
- > Thoroughly clean up debris.*
- > Core aerify the greens with 1/2" to 5/8" tines and remove cores. Topdress with sand to fill aerification holes. Deep tine aeration is recommended if nematode pressure is an issue. This allows for deeper penetration of the methyl bromide.*
- > If you are fumigating, remove up to a 6' wide strip of sod from the perimeter of the green so that you can fumigate outside the wall of the green.*
- > Hot gas fumigate with methyl bromide at 400 to 500 lbs per acre. Remove covers after 48 hours and wait 24 hours before planting.*
- > Plant greens at the rate of 8-10 US bushels (1.24 cu. ft.) per 1000sq.ft. with certified TifEagle sprigs from an authorized No-Till Grower/Installer. Topdress and roll surface after planting. Irrigate as you would for a conventional grow-in, keeping the sprigs constantly moist until rooted.*

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Top-Quality Sprigs

As a patented variety, TifEagle can only be sold as certified sod or sprigs and only by a licensed member of the TifEagle Growers Association, whether for no-till, conventional reconstructions or new installations. A select group of top-quality TifEagle growers have been specially trained and authorized to handle all no-till TifEagle on-site inspections, sales and installations. All TifEagle production fields are inspected three times each year for varietal purity and problem weeds. As an additional safeguard, all no-till TifEagle production fields will be inspected and tested for sting and lance nematodes. To insure freshness and planting uniformity, no-till TifEagle sprigs will be cleaned and milled to remove thatch, dirt and overly large sprigs and clumps, and then delivered in sealed plastic bags or refrigerated trucks. Our goal is to make sure you get a rapid, problem-free grow-in.

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Irrigation

Irrigate once per hour (2-3 minutes per head) to keep the sprigs and surface moist until sprigs begin to establish roots. Gradually reduce your irrigation frequency with appropriate increases in the rate until about 21 days. Then irrigate once every 3-5 days depending on rainfall and cloud cover.



Fertility Management

Apply 1/2 lbs. N (soluble-not slow release) when growth begins. Then 1/2 lb. N per week for the next 6 to 8 weeks. If a peat-sand mix is used to restore grade, add 1 to 2 lbs. of slow release nitrogen and work into the upper 1 to 3 inches with a bunker rake. Maintain an N:P:K ratio of at least 1:1:1 during grow-in. You should get 90% coverage in 3 weeks with proper establishment protocol. After eight weeks, follow conventional maintenance fertilization protocols.

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Mowing Recommendations

Roll frequently prior to first mowing. Begin graduated mowings at approximately 0.180 inch (4.5mm) once rooting occurs (usually in 10-14 days). Mow at least 2-3 times at each new height of cut. Reduce mowing height down to 0.165, to 0.156, to 0.140 and finally down to 0.125. Begin verticutting and topdress at 75% coverage. Aerify with 1/2" tines at 6 weeks after planting to smooth and soften surface.

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Inspect the Progress of Your Greens

Check all greens frequently and note the progress of establishment. Deal with problems immediately. Your No-Till TifEagle Grower-Installer will also conduct an on-site inspection of each green, usually within a month after your no-till greens have been planted. A follow-up inspection visit will be made at between 6 and 12 months.

On-Going TifEagle Management

In many ways management of TifEagle is similar to Tifdwarf. However, as a result of its distinct genetic background, turf density, and ability to tolerate extremely low heights of cut, several suggested management practices are specific to TifEagle. TifEagle will thrive if you follow the management practices for plant health discussed in this booklet. In fact, the management practices outlined in Section 5 can help you avoid problems and help your TifEagle reach its full potential as a putting green turf.



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General Management Guidelines During Active Vegetative Growth

We encourage each superintendent to review these suggested management practices very carefully. You need to determine if your personnel and budget will support the required TifEagle management inputs necessary to maintain a top-quality putting surface.

Each golf course will be different and each green on the same golf course may require a little different management depending on slope, angle of sun, macro and micro-environments, shade, wind movement, etc. Evaluate your greens each week and implement only the practices needed to produce the putting surface required by your members. Learn from your neighbors, but use their practices only if they will improve your greens.

TifEagle is recommended for closely mowed areas only. A suggested alternative for collars is certified TifSport Bermudagrass turf. Maintain a border between TifEagle and the collar area with a non-selective herbicide such as Roundup or Finale until TifEagle is established and being routinely mowed at 0.125 inch (3.2mm).

On-Going Fertility Requirements

TifEagle needs less nitrogen than Tifdwarf due to increased density. Apply only enough N to maintain a quality putting surface or density (not color), usually 0.5 to 1.5 lbs/1000 (0.25-0.75 kgs./100m²)/growing month. (Note: we recommend higher levels of N during establishment). This averages about 1/2 lb.(0.25kgs) of N for every two weeks of active plant growth. Use higher rates of N during periods of active growth and after vertical mowing or aeration. Apply N immediately after vertical mowing or aeration to help turf heal and recover. Use soluble sources. Monitor potassium levels on soil reports and maintain high levels. On an annual basis apply at least one pound of K per pound of N. Fertility levels will vary depending on whether you have an 8 or 12-month growing season or somewhere in between. The longer growing season will require more fertility than a shorter one. Some have observed benefits to rotating (changing) the N source.

- >High rates of N can increase thatch buildup.*
- >Large size granular products will be picked up by mowers due to the height of cut and density of TifEagle. Suggested alternatives are micro or mini particles or highly soluble granular materials. Use particle SGN (size guide number) 100 or less to reduce pick up by mowers.*

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Fertility Requirements - continued

> Use of liquid fertilizer materials has improved consistency of color and putting surface performance of TifEagle. This is probably due to the ability to better manage plant tissue nutrient levels.

> Soil test for P, K, Ca, Mg and lime needs at least twice yearly on sand greens. On high CEC or push-up greens, once per year should be adequate.

> TifEagle responds to micronutrients.

Irrigation Recommendations

Irrigate to prevent stress. Heavy infrequent irrigation is preferable to frequent light irrigation after turf is established, to encourage deep rooting. The TifEagle thatch layer as well as sand below the surface can become hydrophobic because of TifEagle's density. Periodic application of a good wetting agent, frequent quadratine aerification, and/or use of a hydrojet can lessen these hydrophobic conditions.

Mowing Height Guidelines

Mow your grass at the height that is best for your course, depending on several variables. Some important considerations are: the amount of play (higher cut to tolerate more traffic), environmental condition (higher cut if cloudy, cool, poor water quality, etc), greens slope and contours, health of grass (fertility, disease, nematodes).

Mowing Height Guidelines - continued

> Mow at least once daily at 0.156 inch (4.0mm) or lower during periods of active growth. Double mowing will add speed and smoothness, but is probably not needed when grass is growing slow (e.g. spring and autumn). During extended periods of stress, height of cut should be raised (maybe as high as 0.180 inch [4.5mm] during the cloudy and rainy periods common in tropical areas). Raising the mowing height as much as possible in the autumn will improve winter survival, especially in the transition zone where there is a chance for winterkill. Remember, lowering the height of cut also reduces the amount of leaf area available to intercept sunlight and to produce energy for plant growth and maintenance. TifEagle can tolerate much closer mowing than Tifdwarf, but it also has its limit. Excessive low mowing reduces root growth and shade tolerance and increases the potential of soil borne and foliar diseases.

> Walk-behind mowers provide an optimum surface and produce less traffic stress on the grass than triplex mowers. New flex mowers can eliminate some scalping.

> During periods of rapid growth, do not decrease height of cut more than 0.010 inch (0.25mm) every 4 days.

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Thatch Prevention

Thatch prevention rather than thatch control is a key concept. Thatch is the layer of organic material including stems and roots between the soil surface and the green vegetation.

Unhealthy thatch has very little sand mixed within the layer, and poor aeration, water infiltration and rooting are common. In contrast, thatch should not be confused with mat.

Healthy mat is a layer of stolons and rhizomes mixed with soil, sand or other topdressing materials. A healthy mat layer is desirable, but try to keep the layer less than 1/2 inch (12mm).

The specific management protocol for managing this mat layer will depend on season, weather, fertility and growth patterns of the grass. If thatch develops or the mat layer becomes excessive (hydrophobic, scalping, spongy, etc.), implement elimination procedures slowly. Severe verticutting and/or aerifying will result in damaged greens. Verticutting during active growth periods will not reduce the amount of injury, but will shorten the recovery time. There are a number of practices we recommend to prevent excessive thatch formation and to provide optimum putting speeds with true ball rolls.

>Frequent light topdressing or dusting with sand (5-7.5 kg/100m², particle size on the finer side of the USGA specifications so as not to cause mower damage or pickup) is critical for growing a healthy mat layer instead of thatch.

Thatch Prevention - continued

Topdressing maintains pore space in the stolon/rhizome layer to improve water movement and aeration. Without sand, the stolons and rhizomes become compacted with decaying leaf material, creating low oxygen conditions, which reduces root health and growth. Eventually, the stolons and rhizomes die and become part of the problem rather than providing carbohydrate reserves for the plant. Start early in the spring when the grass begins growing. You may want to dust every 2 or 3 weeks in the spring and autumn when the grass is growing slower, but once every week in the summer when the grass is rapidly growing. Use dry bagged sand if possible. Use a spinner type machine. Light and frequent is much better than excessively heavy rates. TifEagle does not like heavy topdressing.

>Brushing daily (with the brush behind the front roller or somewhere in front of the bedknife) and/or turf grooming 2 or 3 times a week are excellent ways to help prevent thatch. The type of brush is probably not that important. The purpose of the brush is to raise the stolon tips so they can be cleanly cut. Grooming should be more aggressive when the grass is rapidly growing and less aggressive in the spring and fall when growth has slowed down. Some superintendents have eliminated light verticutting by using brushing, grooming and light topdressing.

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Thatch Prevention - continued

>Light verticutting (usually during the months of rapid growth and in more tropical climates also during spring and autumn) alternating with topdressing is an excellent tool for promoting a smoother ball roll. Verticutting requirements depend to a large degree on location, weather and fertility rates. Some greens may benefit from vertical mowing in two directions, whereas that may not be necessary for others. TifEagle usually does not tolerate deep verticutting; however, some superintendents have had good experience in removing thatch by verticutting 1.25 inches (30mm) deep in late spring or early summer when growing conditions are ideal. The greens are topdressed immediately after verticutting. Vertical mowing (particularly deep and aggressive) may create an environment conducive for decline, slow recovery, and a poor playing surface during periods of stress (e.g., high temperatures, cloudy weather, rain, etc). Thatch prevention via methods mentioned above is preferred over thatch remediation. A preventative fungicide application may be necessary prior to verticutting.

Aerification

A good aerification goal is to impact 10-15% of the surface area at one time in sub-tropical climates, and 15-20% in tropical climates. Employ close-center aeration in the late spring and fall (or as necessary) using 0.50-inch diameter side-eject tines. If necessary modify your aerifier's hole spacing. 1.5 x 1.5" is common as well as 1 x 2". Your core aerations will be more effective without added disruption or delayed turf recovery. Remove aerification cores and debris. Sufficient topdressing material (greens mix sand w/o organic matter) should be applied and worked into holes. Use solid tines, star tines and/or a Hydrojet as needed to enhance infiltration. This will also improve root growth and reduce surface firmness and dry spots. Consult the USGA website (www.usga.org) for details on how tine size and spacing impacts surface areas.

Plant Growth Regulators

A majority of superintendents managing ultradwarfs are applying growth regulators such as Primo to reduce grain and improve surface smoothness. Research indicates that TifEagle plots treated with Primo, at the label rate, during months of rapid growth, maintained higher turf quality, better color, higher shoot density and faster greens speeds than non-treated TifEagle. The Primo-treated plots also recovered more quickly after thatch removal with a Graden mower.

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Scalping

The closer mowing heights on the ultradwarfs can cause scalping on greens with sharp contours. Some of this problem can be solved by reversing the front roller on the mowers to bring the roller and bedknife closer together. Greens contours may need to be softened due to the closer mowing heights of TifEagle. Scalping can also be due to excessive thatch buildup.

Pest Management Requirements

Preventative applications of fungicides are recommended in the transition zone for spring dead spot control and in all regions prior to expected stress periods, whether mechanical (verticutting) or environmental (cloudy rainy periods).

Improving Winter Hardiness

> Gradually raise the mowing height in the fall so that by the time night-time temperatures reach the low 50s (around 10C°), the height is .188 inch (5mm).

> Develop a healthy mat layer of stolons and rhizomes with sand. The recommended mat layer thickness is slightly less than 1/2 inch (12mm). If a thatch layer, that is, a layer of stolons and rhizomes without sand, is allowed to form, the primary roots and rhizomes will develop above the soil, making them more susceptible to freezing temperatures. Deep rooting should be encouraged because it will improve winter hardiness.

Winter Hardiness - continued

> Maintain high levels of K (up to 1N:2K) throughout the year, with special emphasis during late summer and fall.

> Greens covers may be needed in the transition zone when temperatures routinely fall below 25°F (minus 4°C). Use greens covers if temperatures will be lower than 20°F (minus 7°C). Greens with detrimental thatch layers will need to be covered when temperatures are below 25°F.

> Painting TifEagle greens is effective throughout the northern transition zone, or wherever TifEagle is usually overseeded.

Shade Tolerance

Observations on golf courses indicate that TifEagle needs 8 to 10 hours of full sun each day during the growing season. Raising the height of cut can improve shade tolerance because more leaf area is available to intercept the light.

Salt Tolerance

Salinity tolerance of TifEagle is similar to Tifdwarf, i.e., threshold EC of about 3.5-4.0 DSM and 50% growth reduction EC of about 25 (one DSM = 640 ppm).

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Painting vs. Overseeding

TifEagle maintains superior color under cool conditions and provides an excellent putting surface during the winter season, with or without overseeding. In fact, many superintendents are reporting excellent results with painted TifEagle greens.

Overseed Management

The rhizomatous and stoloniferous growth habit of TifEagle coupled with appropriate topdressing and mowing provides an excellent seedbed for uniform overseed establishment. TifEagle's tolerance to close mowing gives the superintendent an excellent tool to manage and control spring transition.

Overseed Establishment

>Surface preparation: Mow at 0.125 inch (3.2mm), spread sand, plant seed, and then topdress. If vertical mowing is used in preparation, leave plenty of time between a vertical mowing and overseeding. If vertical mowing grooves are obvious, the seed will fall into the grooves, creating stripes.

*>Species: Smaller seeded species are preferred. 100% *Poa trivialis* has been shown to be satisfactory.*

>Seeding rate: total 6-12 lbs./1000 sq. ft (3-5kgs./100m²).

>Topdress lightly and drag in with a carpet.

Overseed Establishment - continued

- > Irrigate as needed to keep seed bed moist throughout the day during germination and seedling establishment.*
- > Raise height of cut to 0.140 inch (3.5mm) until stand is established.*
- > Fungicide treated seed and preventative fungicide applications for 3 to 4 weeks after seeding are suggested for pythium control.*

Spring Transition

Practices that have led to successful spring transition with Tifdwarf should be successful when incorporated into the TifEagle management protocol.

- > When weather and course conditions are appropriate for transition, lower cutting height to 0.125 inch (3.2mm) or less.*
- > Grooming at this time may improve putting quality and thin the overseed canopy.*
- > Increase fertility to encourage bermudagrass growth. Limiting water may also help limit the *Poa trivialis* growth.*

*For information on insects, diseases
and weeds, visit:
<http://www.georgiaturf.com>*

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appendix

Keep in mind that during the renovation decision process, it is very important that you evaluate your greens for external growing conditions, because no-till renovation alone will not solve problems such as poor air circulation or excessive shade. The Green Section Record article "Helping Your Greens Make the Grade," by Jim Moore, March/April 1998, provides an excellent scorecard that you can utilize to grade difficult green sites to make sure all external factors are addressed. Mr. Moore's article can be accessed online at: www.usga.org/turf/articles/construction/greens/make_the_grade.html

Light and Tree Shade Problems

Growth is necessary for a plant to withstand and recover from wear and tear. Therefore, it stands to reason that the more light is limited, the less able the turfgrass is to withstand traffic. The key factor to keep in mind is the number of hours of full sunlight that each area of the green receives during the growing season (May-September). Tree pruning and in some cases complete tree removal will be necessary to provide better growing conditions. It is easy to forget that trees grow larger every year and as a result block more light each season. Keep this in mind when someone observes, "We never used to have problems with that green."

Surface Drainage

Surface drainage is extremely important to every green, including those that drain well internally. Even the best constructed rootzone will gradually drain more slowly. This is due to the production of organic matter by the plant and the introduction of soil fines (notably clay, silt, and very fine sand) into the rootzone over the years. These fines are introduced through topdressing, wind, and even during irrigation when the water supply contains suspended solids. It is even possible for some types of sand to be chemically weathered, resulting in a reduction in size.

Without good surface drainage, water collects in the low areas of the green causing extremely poor growing conditions for the turf. The rootzone becomes saturated and can remain that way for extended periods of time. This results in anaerobic (without oxygen) conditions which will shortly lead to the death of the plant roots. Disease incidence also increases, as does the occurrence of algae and soured soil (often referred to as black layer). Playing quality decreases - both as a result of weak or lost turf and the inconsistency in surface firmness. Surface drainage can occasionally be improved by lifting the sod, adding additional rootzone mix to eliminate the water-collecting hollow, and replacing the sod. Obviously this step is practical only in small areas and near the edge of the green.

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Surface Drainage - continued

Sometimes surface drainage is blocked by the development of thick thatch in the turf immediately adjacent to the green. Removal of the sod and thatch followed by replacement with a thatch-free sod may be all that is necessary to allow water to once again flow off the green.

Internal Drainage and Rootzone Porosity

Internal drainage and rootzone porosity are often the only factors considered when determining the need for the complete reconstruction of golf greens. The USGA provides specific guidelines regarding these factors (see the USGA's Guidelines for a Method of Green Construction.) However, all too often greens will be rebuilt to meet these guidelines without consideration of the many other factors that contributed to the poor performance of the original green. Not surprisingly, the new green does not perform as well as expected. Internal drainage and porosity are extremely important, but they cannot compensate for lack of light, poor air movement, and poor traffic control.

Good internal drainage is without question very influential to the overall performance of the green - particularly in adverse climates and in areas where water quality is less than ideal.

Internal Drainage and Rootzone Porosity - continued

The degree of internal drainage is measured as infiltration rate or hydraulic conductivity.

Rootzone porosity represents the sum of two types of porosity - capillary and non-capillary.

Capillary porosity is a measure of the percentage of pores in a rootzone mixture that are filled with water, while non-capillary porosity refers to the percentage of pores filled with air.

To determine these factors accurately, samples should be removed from the green and submitted to an accredited physical soil testing laboratory.

Short of complete reconstruction, the most effective means of increasing internal drainage and porosity is increased aerification. Often a combination of deep tine and conventional core aerification is necessary. Many courses now include water-jet aerification as a supplement to (not a replacement of) their mechanical aerification practices.

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Organic Matter Buildup

Research has shown that greens built to USGA specifications maintain their original integrity below about the 4-inch depth many years after construction. It's the upper 3- to 4-inch zone that undergoes a drastic change in composition in the field with age. An increase in silt and clay from topdressing, wind movement, or sometimes through suspended solids in irrigation water, creates this change in the upper zone. Organic matter (OM) buildup, however, is the primary cause of poor infiltration, black layer, increased algae on the surface, poor rooting, localized dry spots (LDS) and soft playing surfaces. This zone also can remain quite wet because organic matter increases water-holding capacity.

Fortunately surface organic matter accumulation can be managed by a combination of the following practices.

>Dilution: Dilution of surface organic matter through aggressive topdressing, especially in combination with hollow-tine aeration and verticutting, is the backbone of any successful program. This is important for getting oxygen diffusion into the zone to reach the underlying roots.

Organic Matter Buildup - continued

Developing and maintaining deeper roots allows for less frequent irrigation so that the surface zone has the opportunity to dry out somewhat, which greatly improves the oxygen status.

If your topdressing and cultivation programs are not sufficient to control organic matter, the result will be shallow roots, which require frequent, light irrigations and frequent spoon feedings.

This situation fosters even more organic matter buildup. USGA agronomists Pat O'Brien and Chris Hartwiger have an excellent article that provides good options and guidelines for bermudagrass greens: "Aeration and Topdressing for the 21st Century," USGA Green Section Record 41(2):1-7.



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Organic Matter Buildup - continued

If you feel you have organic matter or layering problems, it is important to take core samples of the suspect greens for lab evaluation.

Undisturbed soil core samples can be taken by driving a 3-inch PVC pipe through the green profile and gravel blanket and into the sub-grade. To remove the core, drill holes in the top of the pipe, put a piece of rebar through the holes, and pull the pipe out of the green. Seal the pipe on both ends and send it to an accredited lab for an undisturbed core evaluation. The lab will test the profile as it exists in the field, as well as the upper 3 to 4 inches and the lower 4 to 12 inches. The results will help determine if the green profile is functioning properly.



Layering

Accumulated and degraded organic matter resulting in black layers is known to significantly reduce water and oxygen movement within the greens profile. Research has also shown that hydraulic conductivity is influenced by changes in sand/soil texture and organic matter content. In general whenever there is a sharp boundary between differing organic matter contents, or sand/soil texture, there will be an effect on water (and potentially oxygen) movement and availability.



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Layering - continued

When organic matter or fine sand/soil particles overlay coarser materials, a perched water table will result, producing saturated conditions and reducing oxygen availability. Severe organic build-up results in anaerobic conditions and black layer development. When coarse materials at the surface overlay fine-textured materials, it is difficult to maintain adequate profile moisture in the upper zone as capillary water is "wicked" out of the coarse-textured zone. Visual evaluation of the greens profile will usually be adequate to identify harmful layers.



Layering - continued

The potential of creating layers that will limit hydraulic conductivity is a dilemma when selecting sand for the light topdressing programs required for ultradwarf greens. Regular greens mix sand contains a high percentage by weight of large particles that stay on the surface of ultradwarf greens. The first mowing picks up all the particles remaining on the surface and removes them to the clipping pile. The result is dulled mower blades, a topdressing application that is only 20-30% of the recommended rate, and the potential for excess thatch buildup. The alternative is to use finer grade sand, but along with that comes the fear of creating layers that may compromise hydraulic conductivity. The question then becomes: which is the lesser of the two evils, thatch or layers? But the possibility of layers from using fine topdressing sand can be overcome with core aeration once or twice a year, followed by topdressing with greens mix sand. The buildup of excessive thatch cannot be remedied as easily and potentially will cause a significant decline in putting quality, an increase in disease pressure, and shallower rooting. So the best alternative is to select a fine routine topdressing sand that will "filter" into the greens surface and to maintain hydraulic conductivity with a core aeration protocol that replaces the organic cores with regular greens mix.

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Nematodes

Nematodes need to be under control from the beginning or you will 'fight' this battle down the road. The following chart lists threshold levels set by Georgia, Florida and South Carolina:

Nematode Threshold Level (No./100 cc Soil)

<u><i>Nematode Species</i></u>	<u><i>GA</i></u>	<u><i>SC</i></u>	<u><i>FL</i></u>
<i>Sting</i>	10	16	10-25
<i>Lance</i>	60	50	40-120
<i>Root Knot</i>	80	40	80-300
<i>Stubby Root</i>	100	100	40-120
<i>Ring</i>	500	--	500-1000
<i>Spiral</i>	--	--	150-1500
<i>Lesion</i>	--	150	--
<i>Sheath</i>	--	200	--
<i>Awl</i>	--	80	--

Check to see if your state has threshold levels for nematodes in turf. If not, these thresholds can be used as a guide. Sample greens and collars separately. Take 20 one-inch cores, 3 to 4 inches deep per green and composite. Sample in a zig-zag pattern across the green. Take individual samples from weak areas with suspected major problems. Keep samples cool and send to appropriate state or private laboratory for testing.

Nematodes - continued

If sting or lance nematodes are present, or other nematodes are cumulatively near or above your state's threshold numbers, you should fumigate with methyl bromide or another effective fumigant before you no-till renovate. When you choose an authorized no-till TifEagle grower/installer, you can be sure the sprigs you receive from the farm are within the suggested threshold levels listed below.

Suggested Maximum Nematode Levels on TifEagle Turfgrass Farms (No./ 100 cc Soil)

<u>Nematode</u>	<u>Number</u>
<i>Sting</i>	<i>0</i>
<i>Lance</i>	<i>0</i>
<i>Stubby Root</i>	<i>20</i>
<i>Root Knot</i>	<i>40</i>
<i>Awl</i>	<i>40</i>
<i>Spiral</i>	<i>75</i>
<i>Lesion</i>	<i>75</i>
<i>Ring</i>	<i>250</i>

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appendix

Greens Speeds/Cupping Areas

Since the Stimp measurements of high quality TifEagle greens will greatly exceed what is routinely possible with Tifdwarf and other traditional bermudagrass varieties, there may be situations where greens architecture will not support the increased greens speeds. If ball speed is too great for the greens architecture, not only will golfers be unhappy, but play will be slowed and available rounds will decrease. If cupping areas are reduced to maintain acceptable putting difficulty, the wear and tear on the greens near the pin placement may be excessive during high use periods. The table below provides an estimate of putting difficulty as it relates to cumulative slope and Stimp readings. If you have any questions whether greens topography will be a limiting factor in the playability of your TifEagle greens, we suggest you contact your golf course architect for advice.

<u>Stimp</u>	<u>Difficulty</u>	<u>Cumulative Slope</u>
9.5	easy	<=2%
9.5	difficult	2%-5.5%
10.5+	easy	<=1%
10.5+	difficult	1%-4.5%

Source: Tom Marzolf

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For More Information: Contact One of These Authorized No-Till TifEagle Grower/Installers



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