Everything you wanted to know about . . . turf aeration

BY **BRYAN WOOD**

No turf area is immune to compaction's devastating effects. Whether it's between the hashmarks, a goalmouth, or just a shortcut everyone takes through the grass, the damage from compaction is very easy to spot. When you see these visible signs of compaction they are just the "tip of the iceberg" and very likely there are similar problems are present in your soil.

The primary means of relieving compaction is aeration. You can choose many methods of aerifying for the differing conditions and situations in a given area, and each method will yield differing results. What is best? Deep or shallow tine, coring or solid tines, slicing blades, vertical linear aeration (deep power slicing)? How to choose what's right for you is the question we want to answer.

Having been in the aeration business for more than 20 years and having visited thousands of golf courses, athletic complexes, and sports fields in the US, Canada, and Mexico, I have found that the problems are all the same and the options have clear advantages and disadvantages.

Deep or shallow?

The age-old question is, should I deep tine or shallow tine? Several years ago, Dr. Houston Couch of Virginia Tech spoke on the subject of deep tine aeration and one attendee asked, "My old aerifier went three inches deep and the root system stopped there. My next aerifier went four inches deep and the roots stopped there. Now I started deep tine aerifying and my roots seem to be stopping there. What can I do now?" Dr. Couch looked perplexed and humorously responded, "And what's the problem with 10-inch roots?" That little remark encompassed my view in a nutshell. Given the choice, go deep. It's true, the root system usually does stop where the aeration tine stops. But at 10 inches deep, the root system will support a healthy stand of turf. I have even seen 10-inch poa annua roots in golf course greens! Irrigation intervals can be lengthened, fertilizer applications can last longer, and more oxygen is introduced into the soil by using deep tine aerification. Before you start a deep tine aeration program just make sure the irrigation lines and wires are deeper than the aerifying depth. I have seen lots of "scenic fountains" pop up unexpectedly during aerification.

The old rolling type shallow aerifier is still cheap and fast, but there is minimal compaction relief and generally produces tufting around the holes. Now with the new designs of deep tine heaving machines that are faster than ever before (over 2 acres/hour), deep tine aeration is now even a more economically feasible option for multiple athletic complexes.

Due to the straight up and down (SUD) action of conventional aerifiers, compaction relief between the holes is minimal at best. SUD aerifiers, although still manufactured, are a bit out of date given the newer technologies available in aerifying. Even the vertical drilling machines produce little to no compaction relief between the holes. I recommend choosing an aerifier with a positive heave action that breaks up the compacted turf between the holes. This introduces needed oxygen, will increase the total cation exchange capacity, and can improve drainage both horizontally and vertically throughout the soil profile. Plus, at the bottom of each stroke, the heaving tine is moving horizontally as it is moving vertically, thus having a slicing plus a lifting action to the turf. This type of action minimizes the creation of a hardpan layer caused by the traditional pounding action of the old SUD aerifiers.

Rather than compressing the soil and actually adding to the compaction problem, the process of the "heaving" displaces the soil upward, raising the playing surface from "not noticeable at all" to "1/2 to 3/4 of an inch," depending on how the machine is adjusted. Matching the extent of the heave for the given soil conditions can be critical in producing good quality results.

Solid or coring tines?

Solid tines are available in either SUD or heave action aerifiers. I recommend the latter because of the minimal damage with maximum results of a heaving machine. Using solid tines with a SUD aerifier can do more damage than good. With SUD aerifiers, solid "shatter tines" will go straight in and out of the ground and can only shatter the soil if the conditions are desert like, rock hard, or bone dry. The aerifier would have a hard time driving the tines into the ground to any considerable depth without causing undue damage to the turf and the machinery. Obviously solid tines on a SUD machine are not a good choice for extended usage.

Because none of the S.U.D. aerifiers have any type of positive heave action, solid tines in these types of machines can only be used successfully as a shallow pin spiker (possibly on "in season" athletic fields), but are really only good for opening the thatch surface during high stress times. Again, this is only opening the surface, not relieving compaction. Be careful not to use this method too much or you will have a "sheep's-foot roller" effect and create a really bad hardpan layer in the soil profile. I've seen these hardpan layers so severe that not only was there a toxic gas build-up underneath but the soil also had a toxic chemical layer.

So when using SUD aerifiers, whether going deep or shallow, you should avoid using solid tines and stick to coring tines for compaction relief. Solid tines can effectively be used with deep tine "heaving-type" aerifiers with little or no damage to the turf. With solid tines ranging from 3/16 to 1 inch in diameter and 6 to 16 inches in length, the ground doesn't need to be bone dry but only needs sufficient moisture for optimal penetration and compaction relief.

On the subject of coring tines, you will find that almost all aerifiers offer some type of coring tine. Most people think you have to pull a core for thatch removal, but the process only provides 5% of the total thatch removal necessary. About 95% of thatch control is normally maintained by verti-cutting and topdressing, or in the case of athletic fields, physical destruction by player's cleats.

Ironically, maintaining a certain amount of cushion, or thatch layer, is good and most athletic field managers would love to have some thatch in the middle of a football field. This helps protect the crowns of the plants plus keeps players from making a muddy pigpen of the field during wet conditions. The only other advantage in using a coring tine on an athletic field is to bring soil to the surface for topdressing, but even this usually doesn't outweigh the benefits of virtually no-mess solid tines. Just order a few extra tons of topdressing material to make up for not bringing up the extra soil.

Another relatively new aeration choice for compaction relief is deep power slicing that is accomplished by driving long 10 to 16 inch blades through the soil. These blades are mounted on a rotating shaft and powered by a chain drive from the PTO driven gearbox. These blades are offset in their mounting so as to penetrate the ground in alternating fashion to create a side-to-side "wave" action to loosen the turf. These blades do not bring any soil to the surface but do provide a considerable degree of compaction relief. This type of equipment produces a continuous slit in the ground and is slightly more prone to drying or desiccation along the edges of the slice. This type of vertical linear aeration (VLA) machine can usually penetrate deeper in the same soil conditions than a reciprocating deep aerator can. Since this machine uses far fewer moving parts, it is easy and less expensive to maintain. I recommend this method for heavily compacted soils that may be extra hard or rocky and more difficult for a deep tine aerator to penetrate.

A slicing roller sounds very simple...that's because it is. Slicing, although not really intended for compaction relief, can be beneficial to turfgrasses that produce stolons and/or rhizomes such as blue, zoysia or Bermudagrasses. By slicing the stolons and rhizomes, new mother plants are created that will send out new rhizomes and stolons with a vertical growth pattern. This also gets accomplished with VLA and to a lesser degree with any of the aforementioned techniques. As far as loosening the soil, the effects are generally minimal. In fact, the compaction can be increased through the "sheep's-foot-roller" effect with extended use. Therefore, some kind of compaction relief program needs to be used. Some methods are designed with

twisted or angled heaving knives to provide some compaction relief. These do have some loosening capabilities, but may cause damage to the turf. It is a cheap way to aerify if you can afford the healing time.

How deep?

I'm most frequently asked how often one should deep aerify. The answer is really in understanding deep aeration as a means of preventing compaction rather than relieving it. As a golf course superintendent, I deep aerified greens in spring and fall, fairways in summer and needle-tined greens during the summer months. In this way, the problems associated with compaction were greatly reduced and my turf generally flourished even in hot weather.

Sports field managers could adopt a program of deep aerating as often as desired. If you are working on a tight budget, this may determine the frequency of your aerification program. For example, if you own a machine, a program of on-going use doesn't cost much more than the occasional use, just additional top-dressing, tines, and labor. If you choose the on-going program you will find that the tremendous savings in applied chemicals, irrigation water, and greens rebuilding will more than offset the purchase price of a deep aerator.

For those with limited budgets, financing is a solution to getting this regular usage and the accompanying savings. Many customers, however, hire a contractor to get the job done. They have a couple of reasons for contracting the job out; they want to see the finished results and are relying on experience of the personnel before they make their purchase. Also, just a spring and/or a fall deep tine aerification program yields unparalleled results as compared to conventional aerifying and is very reasonably priced by many contractors.

Be sure to choose a company who uses the best aeration equipment and employs experienced operators with the knowledge to make correct decisions for your turf conditions. Knowing the proper machine adjustments, hole spacing, tine choice, soil/ turf tolerance, and weather conditions will greatly impact customer satisfaction in terms of healing time and playability.

Whether purchasing an aerifier or hiring a contractor, the proper machine and operator, combined with the proper tines or blades for the desired application, can make the difference between satisfaction and disappointment. Just remember, don't try too radical of an approach at any one time. The main thing to keep in mind for a successful, clean job of aerifying is not to force the machine beyond its capabilities and don't use too large of a tine or a spacing that is too close for the conditions. The soil didn't get compacted overnight and rarely can the compaction be completely alleviated in one treatment. The best route to optimal improvement is making all the right choices, and hopefully it is easier done than said. **ST**

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Getting ahead of field design and construction

BY **JIM PUHALLA**

If you are a sports field manager, grounds supervisor, or administrator in charge of sports fields, you may ask "Why should I care about principles of design and construction?" That's a fair question. Hopefully, your fields have already been designed (and constructed) by people with sound knowledge of these principles who designed a facility that is easy to keep playable.

However, many of the daily challenges you face in preparing your fields for competition are profoundly affected by the decisions made by its designers sometime in the past. The more you know about how these decisions were made (and about errors which were made during the design process), the better prepared you will be to take the steps necessary to adequately support competition.

For example, field managers will be able to make better decisions about field renovation and or maintenance based on a sound knowledge of field design. If a baseball field skinned area drains toward the outfield grass, the challenge would be to keep a lip from forming in that area so water can flow freely into the grass. If the skinned area drains toward the foul lines, then the grass in that area must remain flat for water to flow off the playing surface.

Many field managers are intimately involved in the process of designing and constructing new sports facilities. Under these circumstances, you have the option of simply leaving this work to professionals hired for the purpose. However, it's worth considering that if these people make mistakes (and, sadly, sometimes they make serious ones), you will be the person responsible for cleaning up after those mistakes, sometimes for years to come.

If, on the other hand, you have taken time to familiarize yourself with the basic principles of field design and construction, you will be in a position to ask questions, make suggestions, and warn against errors. So the time invested in learning as much as you can about the design and construction process will pay huge dividends in time, money, and headaches.

Here are some or the most common design errors and solutions.

1. Incorrect Field Contours

* Sports field contours are expressed as percentage of slope. Any slope that is less than 1% (except baseball/softball infields which should be .5%) or more than 2% is considered to be incorrect. The preferred slope for sports field grass areas is 1.25% to 1.75%. Baseball or softball field skinned areas should be between .5% and 1.75%.

* A baseball or softball infield should never be the lowest point on the field but rather the highest point to enhance surface drainage.

* If the contour is not even and consistent, it is incorrect. A field with a 1.5% slope

Scarify the existing soil to prepare for the addition of soil to raise the grade. Avoid placing new soil over compacted soil. This will form a layer that will inhibit internal drainage.

Topsoil and skinned area soil is brought in so the final grade can be set. Grade and scarify the soil in preparation for seed, sprigs, or sod.

should be graded evenly with an 11/2-foot difference in grade over a span of 100 feet.

2. Failure to Isolate Fields as Drainage Units

* No field should be expected to drain away more water than what falls on it. Even if a field is built with correct contours, water running onto the field from another field or an adjacent area can seriously compromise playability in rainy conditions.

* The preferred design isolates each field as an individual drainage unit by using swales and/or catch basins around the field, or by making the field higher than its surroundings.

3. Insufficient Clearance Around Field

* Fields that are designed or constructed with insufficient clearance will have inherent problems: out-of-bounds areas may be too small for the safety of players, spectator areas may be cramped or unsafe, and surface drainage around the field may not work as intended.

* Consider space requirements in the planning stages. Make sure there is enough space around each field before construction begins to prevent it from being "locked in" by other fields, parking lots, roads, buildings, etc.

4. Failure to Provide Sufficient Access

* A well-designed sports field includes access roadways for players, spectators, maintenance equipment, and heavier renovation equipment including large trucks.

* Parking lots should be centrally located to provide easy access, especially for elderly and handicapped fans.

Surveying and designing

In designing a field for reconstruction, the first step is to perform a topographic survey including spot elevations, dimensions of the field, and other structures in and around the field like fences, catch basins, swales, etc. (Surveying an existing field can be done by anyone who has experience using a level.) In planning for the reconstruction of an existing field, it's helpful to shoot the elevations of the key points on the field; simply shooting on a grid pattern will miss the most important points that are critical to good playability.

For an existing baseball infield, be sure to take measurements to the backstop, dugouts, fences, and other structures. Shoot elevations at critical points, like home plate, pitcher's plate, the bases, and the fence line. Make sure to survey the outfield on a grid pattern even if you're planning on reconstructing the infield only. The outfield grade dictates what can be done to fix problems in the infield. Include the fence line and foul territory in your survey.

If you're surveying an existing football field, shoot elevations every 10 yards down the center of the field and 40 feet increments toward the sidelines. Include at least 20

Adding soil to raise the grade.

feet outside the field to make sure the grade will carry water off the playing area. In my experience, a crowned field may need the addition of 4 inches of soil from the center of the field to the hash marks to reestablish the crown. Follow the same procedure for all rectangular fields establishing a grid starting at the center line.

Many people assume football fields are crowned down the center when in fact many fields are built with a side-to-side slope. This design works well as long as someone doesn't try to recrown the field. Adding soil along the center line of a side-to-side sloped field will cause the upper half of the field to become muddy in rainy conditions because the additional soil leaves the upper half of the field level or with very little slope.

When designing a new field it is wise to hire a professional surveyor to do the topographic survey. Property lines, utilities, structures, and other limits of construction must be shown on the plan. Simple grid patterns used by the amateur surveyor will not locate these items accurately like the total station instrument that professional surveyors use.

Reconstruction

Let's look at an example of a baseball infield that needs reconstructed. The outfield drains toward the infield causing standing water and unusual wet conditions in the infield. After surveying and designing the project, the infield is raised at the base of the pitcher's mound 18 inches so the infield drains only the water that falls on it and not all the water form the outfield. The first step is to scarify the existing soil in preparation for additional soil to raise the grade.

Then add soil to raise the grade to within 6 inches of final grade. Before adding soil, scarify the soil to eliminate the layering effect that stops drainage. By using equipment with tracks, compaction is minimized.

There are many different pieces of equipment you can use to reconstruct a field. Beware of using heavy-duty wheeled vehicles, because they will cause extreme compaction causing problems for turfgrass roots and internal drainage. Examples are road graders, earthmovers, heavy dump trucks, and even skid steer loaders. Bulldozers and skid steer track loaders are best for moving soil and final grading sports fields because they cause the least amount of compaction. The secret to good sports field construction is scarify, scarify, and scarify. Scarify before applying subsoil, before applying topsoil, and before planting.

Bad designs lead to bad construction, and fields that requires a lot of time and attention to remain playable. On the other hand, good designs and specifications lead to sound construction techniques and fewer mistakes. The result is fields that can be used in all kinds of weather conditions and fields that will support competition for years to come with minimal yearly renovation. ST

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HUSTLER SUPER Z 26-HP

Hustler Turf Equipment's Super Z now features a 26-hp Kawasaki liquid-cooled engine with no mules drives or gearboxes, the vertical crank means simple, direct-drive to deck. Engine sits lower in frame for better center of gravity and performance on slopes. Also features SmoothTrak twin-lever steering with automatic parking brake.

Hustler/800-395-4757
For information, circle 066 or
see http://www.oners.ims.ca/5063-066

BOBCAT DOZER BLADE

Bobcat Company now has a new 96-in. dozer blade model that fits large-frame Bobcat loaders, enabling the machines to excavate and grade more material. There are more than 60 versatile attachments compatible with Bobcat compact equipment. The 96-in. dozer blade complements the 80-in. and 90-in. dozer blade attachments; the 1,500-lb., six-way adjustable dozer blade features an all-cast design for strength and a reversible three-piece cutting edge for extended life.

Bobcat/701-241-8700
For information, circle 067 or
see http://www.oners.ims.ca/5063-067

MAINTENANCE CATALOG

Tomark specializes in field maintenance equipment. A wide selection of traditional maintenance equipment along with many hard-to-find or one-of-a-kind products sets Tomark Sports apart, says the company. Find quality products at competitive prices in both the Baseball/Softball Catalog and Multi-Sport Catalogs.

Tomark/800-959-1844
For information, circle 068 or
see http://www.oners.ims.ca/5063-068

TORO PROCORE

The Toro ProCore 660 aerator, with a 60"-in. width, can cover up to 1.5 acres an hour with 5-in. hole spacing. Designed for large areas, the 880 aerator has 80 in. aerating width for up to 2 acres per hour performance. Both units are tractor mounted and feature the triple belt design for durability and performance in tough soil conditions.

Toro/800-803-8676
For information, circle 060 or
see http://www.oners.ims.ca/5063-060

BROYHILL'S ACCUAIRE

This core aerator's FlexWing design allows it to follow the contour of the ground, providing even penetration. The solid steel frame and extra-wide racks add weight to maximize core depth in all types of soils. Equipped to use slicer blades or core spoons, the AccuAire is available in 69 or 93 in. Units are equipped with a hydraulic lift, and hook up easily to utility vehicles equipped with hydraulics or three-point hitch.

Broyhill/800-228-1003, x34
For information, circle 061 or
see http://www.oners.ims.ca/5063-061

FIRST PRODUCTS' VC-60 VERTI-CUTTER

This unit is designed for continuous heavy-duty operation on all sports fields and all types of turf. VC-60's feature a patented swing hitch that allows you to verti-cut around objects while turning without tearing established turf. Cutting depths are adjustable in the field, without tools, using quick release pins on 3/16-in. increments.

First Products/800-363-8780
For information, circle 062 or
see http://www.oners.ims.ca/5063-062

SISIS ROTORAKE TM1000

SISIS has developed a tractor-mounted, PTO-driven deep de-thatcher/linear aerator with a working width of 39 in., and with floating unit to follow ground contours. With the collector box fitted, the TM1000 will work to a depth of 1 in., or without collection to 2 in. Operating depth is simple and quick to set. A range of blades is available to suit various requirements.

SISIS/864-843-5972
For information, circle 063 or
see http://www.oners.ims.ca/5063-063

DAKOTA INTRODUCES CONVEYER OPTION

Dakota Peat & Equipment has introduced a new rear, industrial grade conveyor option for the Dakota 410 Turf Tender line of equipment. Designed to give the operator maximum material handling control, both the back conveyor and the hopper conveyor can be independently adjusted from a mounted control box at the front of the tractor. Built at the request of customers looking for greater flexibility, the fingertip control feature allows operators to adjust the flow and the amount of material being handled without leaving the seat of the tractor.

Dakota Peat & Equipment/800-424-3443
For information, circle 065 or
see http://www.oners.ims.ca/5063-065

WIEDENMANN'S TERRA SPIKE XF

This deep aerifier can aerify at a depth of 8 1/2 in. at the speed of a shallow aerifier. The exclusive twin drive transmission can produce square hole spacing of 2 1/2 in. and 5 in., with a forward travel speed of 1.2 and 2.4 mph respectively. The quickset feature of the central depth adjustment and the central angle adjustment allows depth and angle adjustments to be performed on the fly. The shock absorbing systems, VibraStop and PowerPack, remove any vibrations resulting from the high aerification speed.

Wiedenmann NA/912-790-3004
For information, circle 064 or
see http://www.oners.ims.ca/5063-064

JOHN DEERE'S AERCORE

The Aercore 2000 features the patented "Flexi-Link" design that ensures tines stay perpendicular to the ground for a consistently round hole. A 77.5-in. coring swath from this tractor-mounted attachment delivers high productivity without sacrificing hole quality, durability or ease of service. This machine will produce coring holes up to 4 in. deep and can cover 100,066 sq. ft./hour. A 2.4-in. or a 3.2-in. pattern, are available, depending on the speed of movement.

John Deere/800-537-8233
For information, circle 081 or
see http://www.oners.ims.ca/5063-081

PLANETAIR'S HIGH DENSITY AERATORS

NEW PRODUCT!

PlanetAir has introduced the High Density 50 Tow and the High Density 50 PTO aerators, which can produce a 1/2-in. hole with a 2x2-in. spacing at a rate of 1.2 acres per hour. The patented coring tine cuts clean cores at the surface and shatters the soil below. This results in up to 90% less clean up; just aerate and mow. The results are more durable, dense and playable turf due to the intense root zone aeration. The shatter knife technology combined with the planetary motion creates pore space through your root zone, with virtually no surface disruption. You can aerate circles around a pitcher's mound, gold post or difficult corners while the aerator is working in the ground without tearing turf.

PlanetAir Turf Products, LLC/877-800-8845
For information, circle 084 or
see http://www.oners.ims.ca/5063-084

REDEXIM'S VERTI-QUAKE

The Verti-Quake is a rotary aerator that de-compacts the soil using a set of rotating steel blades. As these blades cut cleanly through the soil, they create a wave action that shatters compacted areas and opens up the sub-surface. The Verti-Quake is available in four different models and can work at depths up to 22 in. with little or no surface disruption.

Redexim Charterhouse Inc/800-597-5664
For information, circle 069 or
see http://www.oners.ims.ca/5063-069

TURFCO DIRECT'S DETHATCHER 20

Constructed of 10-gauge welded steel, and Dethatcher 20 from Turfco Direct is powered by a 5.5-hp Honda engine. It features 52 heavy-duty flail blades to handle thick, heavy thatch. Offering up to 10,000 square feet per hour productivity, the unit's light weight and ball-bearing wheels provide maneuverability, even on rough turf. Depth is controlled by a micro-screw with large plastic grips for tool-free adjustments. A folding handle facilitates transport.

Turfco/800-679-8201
For information, circle 070 or
see http://www.oners.ims.ca/5063-070