

Everything You Wanted To Know About Aeration...

But Were Afraid To Ask!

By Bryan Wood



Whether on sports fields, golf courses, or playgrounds, no turf area is immune to the devastating effects of compaction. If you have attended your favorite high school's Friday night football game and looked at the center section of the field, you may see some very sparse turf. Compaction contributes to this obvious high traffic problem and is easy to spot. Other compacted areas can be seen around the goal on a soccer field, the path that always appears between the same two bunkers every time people walk from their cart to the green, or just where people take that proverbial shortcut through the grass to the sidewalk. These are only the visible signs, just the "tip of the iceberg", of the compaction problems that are really present in your soil.

Now that you know it's there, it must be remedied. The primary means of relieving compaction is through mechanical cultivation, namely aeration. You can choose many methods of aerifying for the differing conditions and situations in a given area, and each will yield differing results. Which method is best: deep or shallow tine, coring or solid tines, oscillating tines, slicing blades, or 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 over twenty years and having visited thousands of golf courses, athletic complexes, and sports fields in the U.S., Canada, Mexico, and Europe I have found that the problems are all the same and the options have clear advantages and disadvantages. Everyone wants the perfect playing surface, so let's tackle some frequently pondered decisions.

DEEP TINE VS. SHALLOW TINE



Tine pictures from www.JRMonline.com

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 I heard a golf course superintendent ask, “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 ten inch roots?” That little remark encompasses my view in a nutshell. Given the choice, go deep. It’s true that the root system usually does stop where the aeration tine stops. But at ten inches deep, the root system will support a healthy stand of turf. I have even seen ten-inch poa annua roots in golf course greens! With a deeper root system from deep tine aerification, irrigation intervals can be lengthened, fertilizer applications last longer, and more oxygen is introduced into the soil. Some other benefits to deep aeration should be mentioned. For example, some golf courses have completely amended the top 12 inches of their greens soil profile through the creation of deep sand tunnels from topdressing after using large tines and up to 1-1/2 tons of sand per thousand square feet! This amounts to virtually

rebuilding the green from the inside out without taking it out of play and results in a savings of thousands of dollars. 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 two acres/hour), deep tine aeration is now even a more economically feasible option for multiple athletic complexes or golf course fairways. As a side note, before you start a deep tine aeration program, just make sure the irrigation lines and wires are deeper than then the aerifying depth. I've seen lots of "scenic fountains" pop up unexpectedly during deep aerification.

STRAIGHT UP AND DOWN (SUD)



John Deere Aercore 2000 (SUD Type)

VS.



Wiedenmann XF 8 (Heaving Type)

HEAVING ACTION

(pictures are for example purposes only)

Another question to answer is whether to choose a machine with "straight up-and-down" (SUD) tine action or heaving action. I recommend a heaving action aerifier for most applications. Due to the 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 heaving action that breaks up the compacted soil *between* the holes. This introduces needed oxygen, will

increase the total cat ion (kat-i-on) 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 “heaving” displaces the soil upward, raising the playing surface from “not noticeable at all” to “ $\frac{1}{2}$ to $\frac{3}{4}$ 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. For example, after using needle tines, the putting surface should be smooth without using any topdressing and should putt smoothly even after using larger tines and a light topdressing.

SOLID TINE VS. CORING TINE



Tine pictures from www.JRMonline.com

With turf managers and golf course superintendents aerifying year-round for different specific reasons these days, here is a brainteaser question to answer: Should you use solid or coring tines? The answer depends first on what **style aerifier** you're using and then the problems being addressed.

Some say that solid tines cause compaction, but they don't quite have their facts straight. It's not the solid tine that causes compaction, but the machine it's attached to. Solid tines are available for both “**straight-up-and-down**” (SUD) or “**heave action**” aerifiers. An SUD aerifier with solid tines can do more damage than good. Even with coring tines the SUD technology is obsolete compared to heave action machines. In fact, an adjustable depth heave action aerator is the best all around machine choice.

A **heaving action machine** actually slices into the soil profile with a slight lifting action. The tine is in a heaving motion at the bottom of the stroke, thus not creating any hardpan. This creates pore space and increases the cation exchange capacity of the soil. This is how it loosens without pulling a core.

SUD aerifiers with solid tines can be used as a shallow pin spiker (possibly on hydrophobic greens or “in season” athletic fields) but are really only good for opening the surface during high stress times, allowing for quick water and air penetration with minimal disturbance to the surface or sub-surface. Again, this is only opening the surface, not relieving compaction. Be careful not to use this method too much or an even more serious problem will develop. The SUD aerifier will create a “sheep’s-foot roller” effect and 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 generally **avoid using solid tines** and stick to coring tines for compaction relief.

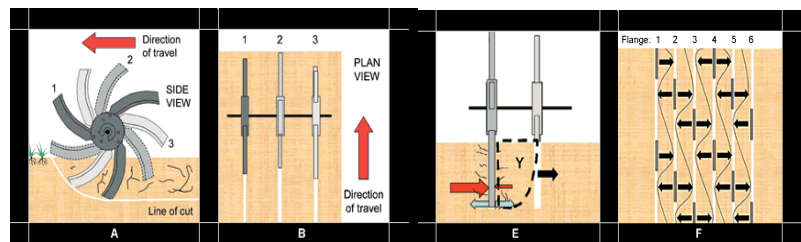
Solid tines can effectively be used, adjusted to any depth, with “heaving-type” aerifiers – the deeper the better. With little or no damage to the turf, these newer designed machines will relieve general compaction as well as relieve the shallow hardpan and toxic layer created by the SUD machines. Solid tines ranging from 3/16 to 1 inch in diameter and 6 to 16 inches in length, and can be used any time the ground has sufficient moisture for penetration. Avoid aerifying any ground (with any style machine) in bone dry condition, or excess damage to the turf and machinery will occur. The old mentality of bone dry “shatter-tining” has been effectively replaced with today’s newer technology.

Turning to the subject of coring tines, they are used for thatch removal, topdressing, and soil amending. Although 90-95% of thatch removal is accomplished through a good verticutting/topdressing program, an important 5-10% of thatch is removed by pulling cores. This is especially helpful during hot, high stress times when the thatch can become hydrophobic and repel irrigation water. Ironically, in high traffic areas such as the center sections of sports fields or cart path traffic areas, a certain amount of thatch retention is recommended. Most turf managers would love to have some thatch in these areas to help protect the crowns of the plants and prevent players from making a muddy “pig pen” of the area during wet conditions.

Another advantage in using a coring tine is to bring soil to the surface for topdressing. This can be cost effective for multiple athletic fields and fairways. Lastly, soil amending through deep tine aerifying with coring tines has been successful for many years now. Through core removal and heavy topdressing, a soil profile can be modified over time without taking the area out of play or spending excessive amounts of money. Care should be taken to either alternate

between solid and coring tines, or perform several extra topdressing applications since the densely compacted soil that is being removed is hard to completely replace with a single topdressing. This will prevent a “sinking” affect of the turf area being cored. You may even consider exclusively using solid tines for soil amending since they will generally heal faster and create less mess. Your turf will love you for it, and the channels created with the deep tine make a permanent chimney of sand allowing water and roots to penetrate with ease and flourish. As you can see, the choice between solid and coring tines varies with the machine design, the problem being addressed, and the desired outcome. There’s a time and place for both.

VERTICAL LINEAR AERATION (VLA) VS. RECIPROCATING



Example: www.Earthquake-turfcare.com

Another choice to consider for compaction relief is the relatively new method of deep power slicing, technically called vertical linear aeration (VLA). The soil loosening capability of this machine is similar to that of the deep tine heaving machines. The difference is in the consequences of the VLA's use of blades rather than tines. VLA's accomplish aeration by driving long 10 to 16 inch blades through the soil. They 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 and create a side-to-side “wave” action to loosen the turf. They do not bring any soil to the surface but do provide a considerable degree of compaction relief. VLA machines produce a continuous slit in the ground which are slightly more prone to drying or desiccation along the edges of the slice. As with most types of aeration, low mowing heights such

as on greens or fairways will require increased irrigation during the healing time. VLA machines 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. These machines can also be equipped with a sand hopper that will gravity feed sand into the slits for improving the drainage.

ROLLING SLICER



Wiedenmann Terra Combi w/ slicing knives.

The slicing roller, yet another aeration choice, 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 Bermuda grasses. 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 V.L.A. 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 utilized. Some slicing models 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.

Oscillating Solid Tines Such as the “Aera-Vator”



Aeravator 60 inch on golf course tee. www.1stproducts.com

While a little too aggressive for fine turf areas such as golf course greens, these types of machines are a good choice for fairway, rough, and athletic field applications. These machines do an excellent job of loosening the top 4-6 inches of the soil profile. They use only solid tines and don't pull out or destroy any of the existing turf. This type aerifier ranked among the highest tested for compaction relief in the top 5 inches in a University of Georgia study. They can also be fitted with a seed box for seeding while aerifying.

PREVENTATIVE VS. CURATIVE

I'm 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 every spring and fall and needle-tined greens during the summer months; I also deep aerified my Bermuda grass fairways during the summer, all with a deep heaving machine. In this way, the problems associated with compaction were greatly reduced and my turf generally flourished even in hot weather. If you are responsible for maintaining sports fields, you 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 topdressing, tines, and labor. If you choose the on-going program you will find that the tremendous savings in applied chemicals, irrigation water, and greens (or athletic field) rebuilding will more than offset the purchase price of a deep aerator! For those with limited budgets, financing a machine 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 are relying on experience of the personnel and want to see results 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.

Water Injection



Example: Toro Hydroject 3010

Water injection can be a useful mode of aerifying in certain situations. This type of aerifier works by injecting high pressure water into the soil. This can be especially helpful when the turf becomes hydrophobic during summer stress. You must have access to a water source via a quick coupler. These injection machines due almost no surface disturbance and greens can be returned to playing status immediately after treatment.

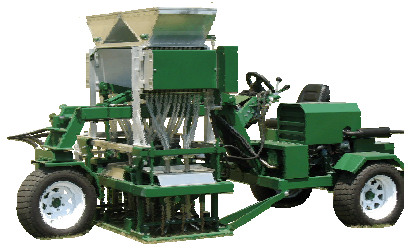
Dry Material Injection



Photo: www.Dryject.com

The dry material injection machines work on the same theory as the water injection. They inject water, but also dry material is pulled by siphon effect from an above mounted hopper. Various soil amendments can be added in this manner for a variety of plant needs.

Drill and Fill



The “drill and fill” machines have been on the market since the mid 1980’s and have been useful in many cases amending poor soil turf areas. These machines can go as deep as some of the deep tine machines on the market, and in some situations can be used with less surface disturbance. The drawbacks to this type of aerifier are:

1. They are slow, when compared to reciprocating deep-tine machines (about 1/4 the speed, depending on soil type and depth).
2. Can be labor intensive keeping the material hoppers filled.
3. Makes a hole, but does minimal if any loosening between the holes.

As I previously stated, these machines do create minimal disturbance to the surface of the turf and playability afterwards is very good.

Micro Tining

Micro tining is performed primarily on golf course putting greens. Very small, solid or coring tines, 1/4 inch. diameter or smaller, can be used to effectively dethatch and/or ventilate a putting green surface. Micro tining does not de-compact the soil since these tines only penetrate the thatch surface and shouldn't get into the soil. Maximum micro-tining depth is generally 1-1 1/2 inches. With the small tine diameter and shallow depth, the green is under very little stress as the oxygen and gas exchange takes place (thus the term "ventilating"). The spacing of these holes should be no farther apart than a 3in. X 3in. spacing. During the growing season, I've seen these holes heal over by the next day. The "Micro Cores" can be blown off by a leaf blower or picked up with a greens mower. Since they are not getting into the soil, this generally doesn't impose a bedknife wear issue.

To Sum It All Up...

Although discussion of every brand and type of aerifier on the market is about impossible, I hope this overview will be helpful to you when making an aerification decision. 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 now, hopefully it is easier done than said.

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