How Deep Are Those Holes?

By Robert Erdahl

Most of the time, I am a conservative kind of guy. I choose my mutual funds carefully, my kids do not own CD players or Nintendos and I listen to Rush Limbaugh whenever I get the chance. Given this state of conservatism, (my wife refers to it as dullness), what could have come over me back in April of 1992 when I started to aerify my putting greens with the Verti-Drain! Was I desperate? How about confused? Perhaps a touch of insanity! While I admit that all three of these sometimes play a role in my decision-making process, they were not a factor this time around. Let me try to explain.

Back in August of both 1990 and 1991, I began experiencing a problem with my putting greens that had not occurred in previous years. When changing cups, the top of the turfgrass plug would crack off right at the interface of the original greens mix and the overlying layer of sand topdressing. In other words, I had no roots below the three inches of Lakeshore Sand topdressing that has been used for the past eighteen years. We all know that roots gradually senesce all summer and are at their lowest mass by mid-August, but this dramatic stoppage of root growth at one depth on a majority of my putting greens had to be caused by a more definitive problem.

What was I doing wrong during this late summer stress period? I checked my irrigation routine, my fertilization practices, my pesticide applications, my usage of wetting agents and my aerification schedule. All five were within the averages for my first six years at North Shore when I did not have this rooting problem. Something was preventing my roots from penetrating the interface because I just could not get roots down into the original putting greens mix.

Now I know what you are thinking, it must be some kind of layering problem—all of that Lakeshore Sand used for topdressing has created a separate three inch thick microclimate on the surface of my putting greens. Well, being an old student of soils, I thought I had negated the effects of layering through years of core aerifying that included removing the cores and backfilling the aerifier holes with Lakeshore Sand. By August of 1990, I had aerified my putting greens eleven times with 5/8 inch coring tines mounted on Ryan Greenaires. By my calculations, that adds up to approximately 1.5 million aerifier holes in an average 5,000 square foot putting green. How can all those holes leave me with a layering problem?

Having tossed aside the notion that layering was my problem, I began to look for other explanations. My first thought was that some kind of chemical reaction was taking place at the interface. Perhaps some kind of toxic layer of soluble salts or pesticide residues had formed. To test my theory, I proceeded to test three putting greens at depths of 1 inch, 3 inches and 6 inches. Using these depths, I hoped to see if any differences existed between the Lakeshore Sand topdressing, the interface zone and the original putting greens mix. The soil tests included pH, major and minor nutrients, soluble salts, general pesticide residues and specific tests for chlorothalonil (Daconil 2787) and propiconixole (Banner), the two most commonly used pesticides on my putting greens. To make a long analysis short, the results did vary based on the depth of the soil sample but there was no evidence to suggest a buildup of any toxic compounds at the interface.

At this point, I turned again to the physical aspects of the soil environment to see if I had missed anything. Looking at the Lakeshore Sand topdressing, all I could see was the obvious—a uniform three inch layer of sand that contained almost ninety percent of the roots. The interface zone created through aerification was approximately three inches thick and contained a 50-50 mixture of the original putting greens mix and Lakeshore Sand. Underneath was the original

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Steve Scoville

POTENTIAL ADVERSE EFFECT OF DEEP-TINE AERATION!

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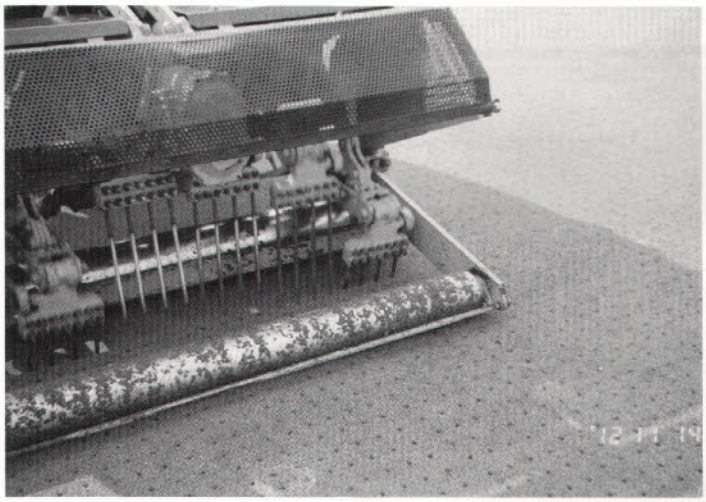
putting greens mix that was prepared on-site using a ratio of two parts very course sand (35% of the particles are over 1.0mm in diameter and 10% of the particles are over 2.0mm in diameter), one part sandy loam and two parts sphagnum peat moss. As you would expect, the combination of on-site mixing and interesting ratio of ingredients produced a mixture that has marginal consistency and does not fall within the guidelines of the USGA specifications. Based on overall performance, however, the mixture had held up fairly well for twenty-five years before the rooting problems developed in 1990.

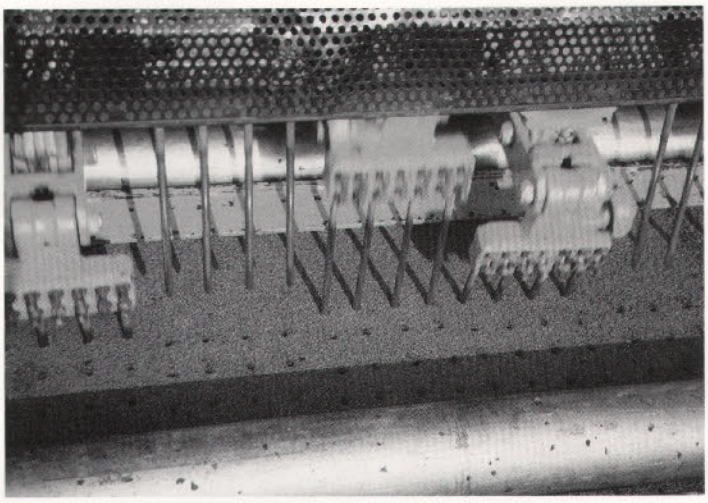
At the same time, I started paying attention to both research and speculation that linked core aerification with soil compaction. You remember the pictures that appeared in some of the magazines—they showed how the soil in the sides and bottom of aerifier holes gets compacted by the penetrating action of the tine. Some studies even suggested the development of a layer of compaction or an "Aerifier Pan" near the depth of aerification that was similar to a "Plow Pan" that can develop in agricultural soils that are always plowed at the same depth. With all the core aerification I had done on my putting greens, they definitely were candidates for this type of a problem.

It was beginning to look like a combination of compaction problems due to my intensive aerification program along with the lack of cooperation between the original putting greens mix and the Lakeshore Sand topdressing (alright, I admit that I may have had a layering problem!) was respon-

On the road with Dave Strang of Mechanical Soil Technology.

Side view of Dave Strang at work with a Verti-Drain equipped with ½" solid tines.





Close up views of the business end of a Verti-Drain equipped with ½" solid tines.

sible for the failure of the roots to penetrate the interface zone.

Now that I had reached a conclusion, albeit a questionable one, my next step was to take some action. Since my problem seemed to exist at a depth below three inches, deep aerification seemed to be the most logical solution. I looked at the Verti-Drain, Floyd-McKay and a bunch of other deep slicers and dicers, but I ruled them all out due to questionable track records or just plain weirdness.

Then along came the Toro Hydroject, and I thought my troubles were over. Right up front, I have to say that Hydroject is a masterpiece of engineering and seems to live up to all the advertising hype that surrounds it. Now that I've said all of those nice things, I have to turn around and tell you why it did not work for me at North Shore.

When the Hydroject sent it's blasts of high pressure water down into my putting greens, the coarse sand particles ricocheted right out of the holes and ended up all over the putting surface. It was a mess! I know that all I had to do was mount three sweeping heads on my GreensKing and the mess would be all picked up in a couple hours, but there were a couple of other nagging questions that were also bothering me. First, I was troubled by more than just the large sand particles coming to the surface. Since my original greens mix contained 20% sandy clay loam, I was afraid of bringing some of this to the surface and contaminating the Lakeshore Sand topdressing. Second, I was concerned just how much benefit I would get from the relatively small holes; or in other words, how often would I have to repeat the process. Third, the Hydroject seemed limited in application to greens and possibly tees. I could not see it doing much good on my fairways where the problems are clay soil and thatch buildup. And finally, I was hesitant to present the Hydroject concept to my Board of Directors, knowing full well that the only part of my presentation they would hear was the part about the Hydroject being a possible alternative to core aerification. None of them would recollect any of my disclaimers about the possible need to core aerify in the immediate and/or distant future.

It was not until early April of 1992 that I finally came to my senses about what to do with my problem. I had just received my copy of the USGA Green Section Record and was reading an article by Bob Vavrek that had the catchy title of "AERATION; Needed More Today Than Ever Before". The following paragraph from that article stopped me right in my tracks:

"Routine use of hollow-tine aeration can create a layer of compaction called a cultivation pan located just beyond the depth of tine penetration. Evidence of a cultivation pan is a soil core that breaks apart about 4" deep when cups are changed. A cultivation pan slows the movement of water through the green and restricts root penetration. An effective way to minimize the effects of this kind of compaction is by deep-tine aerification."

As I stated earlier, I had already known about "Aerifier Pan" and the benefits of deep-tine aerification for almost two full years, but somehow reading that one paragraph brought my entire situation into focus and just like in the cartoons, a lightbulb appeared over my head! Within thirty minutes of reading that paragraph I had talked to Dave Strang at Mechanical Soil Technology and had booked him to Verti-Drain my putting greens in early May. Dave is a contract aerator—more about him in just a bit.

After I hung up with Dave, I had some second thoughts about the whole affair. What had I done? I was actually going to attack my putting greens with a Verti-Drain. Not to worry, Dave had left me an escape. He told me that he was going to do some work for Jerry Kershasky at Westmoor Country Club about two weeks before his appointment with me and he invited me to come over and watch him do his thing. If I did not like what I saw, we would just cancel our date. After a quick call to Jerry, my Verti-Drain demonstration was all set.

It was a beautiful Spring day (40°F, cloudy, 25mph wind) when I got my first look at the Verti-Drain in action. Jerry took us out to his fifteenth green where Dave was busy punching holes with ½" solid tines. What was my first impression? I was amazed at what little, if any, disruption of the putting surface was left after this monster had violently jabbed it's massive tines into the putting green. Discounting for the blips caused by the holes left by the tines, the putting surface was smooth—no pulling up of the turf, no wheel tracks from the tractor, nothing. Next, Jerry put a stiff wire into one of the aerifier holes and marked the penetration with his fingers. When he pulled out the wire, it revealed a depth of twelve inches; deep enough to break through my compaction layer located at three inches. When I left Westmoor, I had two things; first, a firm date with Dave to do my putting greens and second, a debt of gratitude to Jerry for letting me watch as he experimented with the Verti-Drain on his greens!

Since I keep talking about this "Dave", I guess it is time

for a little background information. Dave Strang owns Mechanical Soil Technology, a contract aerifying company that has specialized in Verti-Draining throughout the entire Midwest for the past six years. In 1993, Dave did fifteen Wisconsin golf courses (selected greens only at some golf courses) and many more (Dave told me how many, but he doesn't like to brag so I won't tell) in seven other states. His equipment consists of a pair of Verti-Drain units mounted to compact tractors. He hauls both rigs around on a goose-neck trailer behind his dually pickup truck.

Even though Dave is a "flatlander" and he talks with just a hint of a drawl, he can make that Verti-Drain purr like a kitten. If Dave says the machine won't damage your greens, you can believe him. After all, Dave stood in our boots for six years before starting his business so he understands our concerns about the machine.

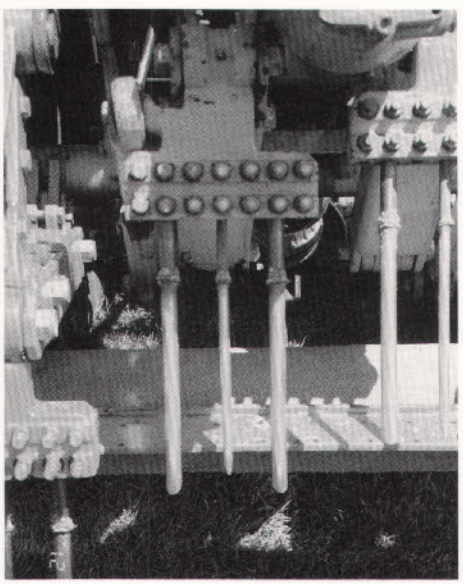
Before you get ready to kiss this guy's ring, don't forget that he doesn't do this as a hobby. If you want Dave to Verti-Drain for you, he charges by the square foot. His 1994 rates are 4¼ cents per foot for the 2"x4" pattern using ½' solid tines and 3¼ cents per foot for the 4"x4" pattern using either ¾" or ⅞" tines (hollow or solid). More about spacing and tines in a bit. At North Shore, I have Dave use the 2"x4" spacing with the ½" solid tines. On my 220 M square feet of putting surface the bill will come to $9,350.00. Bottom line on Dave; he knows his stuff—his Verti-Drain can cure a lot of problems—he ain't cheap.

When Dave showed up at my place back in May of 1992, the first thing he did was to explain all the different tines, spacing and kicks that were available. His machines handle ½", ¾", and ⅞" solid tines along with ⅝" and ¾" coring tines. For my situation we decided on the ½" solid tine. With the ½" solid tine, the hole left on the putting surface is too small to fill with top dressing. If you want to get some top dressing down into your putting greens, you have to use the bigger tines. Next we talked about spacing. I wanted a lot of holes, so we chose the 2"x4" spacing (remember, more holes equals more money). The wider 4"x4" spacing can be used with the ½" solid tines, but is usually used with the larger tines. Note that when I measured the actual spacing of the aerifier holes on my putting greens, the average spacing was 2¾" between holes. Last we discussed the kick-action of the machine. Dave routinely sets his machines to deliver the minimal amount of kick. This results in the tines going almost straight in and out.

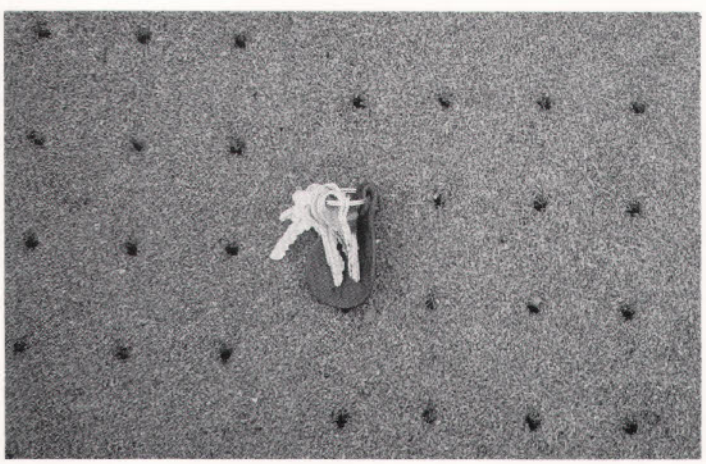
With the machines all squared away, we got down to some serious hole punching. It took both of Dave's units a little more than two long working days to finish up my twenty-eight putting greens. The immediate results were great; minimal disruption of play, quick recovery (the holes were grown over in a week), approximately 125,000 holes on a 5,000 square foot putting green along with twelve inch penetration. Any problems? Yes, a few. Golfers are fascinated by this machine so you have to be on constant patrol to explain exactly what is going on. Underground targets! If it's there, the Verti-Drain will find it! This includes rocks, hydraulic tubing, irrigation pipes, wires and tile lines. If you think your irrigation pipes are deep enough, think again! In addition to it's prowess as an aerifier, the Verti-Drain could be marketed as an irrigation pipe locator.

But was it a success? When August rolled around, all my greens once again suffered from root stoppage at the three inch depth . But wait! Every aerifier hole had a bunch of beautiful, white roots that went all the way down to the bottom—twelve inches deep. A miracle cure? Hardly; my greens did not really seem to be all that much healthier than in the two previous years. A step in the right direction? You bet! I knew it would take more than a one time shot in the arm to cure my problems.

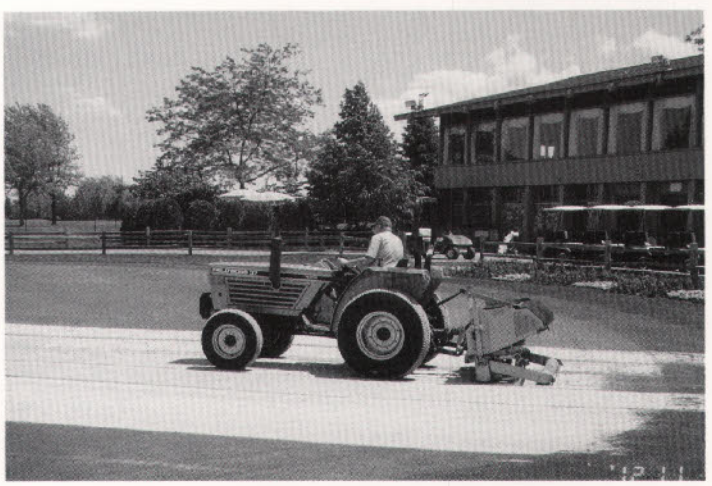
When Spring arrived in 1993, I was anxious to get the Verti-Drain up and running on my putting greens.



Close-up view of Verti-Drain arms equipped with ½" and ⅞" solid tines.



Close up view of a putting green immediately after aerification with a Verti-Drain equipped with ½" solid tines. Hole spacing is approximately 2 ¾".



Side view of Dave Strang at work with a Verti-Drain aerifying through sand top dressing with ½" and ⅞" solid tines.

Unfortunately, Mother Nature had other priorities and my appointment in late April was washed out. Given Dave's tight schedule, if you get washed out, you loose your turn and go to the end of the line; which in this case was June 13 and 14. Mid-June is usually not considered prime Verti-Drain time. But being a bit braver than normal, I told Dave we would try to do nine of my putting greens if it didn't get too hot. What it did do was to rain 1.15" the morning we were supposed to start. "Not to worry," said Dave. "Even on soft putting greens, I don't leave any wheel tracks." Well for some reason I believed this guy and you know what, he was right! The procedure went just as smooth as in 1992. When I checked the greens in August, the roots stopped at the three inch depth everywhere except in the Verti-Drain holes. Due to the extremely wet summer, however, the roots were not quite as numerous as 1992.

And what about the Verti-Drain holes from the Spring of 1992; were they still visible and were they still full of roots? Yes on both counts. From my very limited experience, it appears that the Verti-Drain holes made with ½" solid tines will remain viable at least two years.

After Dave finished with my nine greens, I decided to get really brave and have him blast the poorest part of my practice green with the ⅞" solid tines. To set up the machine, the arms are outfitted with two ⅞" solid tines on the outside and one ⅞" solid tine on the inside. Dave says that three ⅞" solid tines in a row is a little severe! The hole spacing is expanded to the 4"x4" pattern because the ⅞" solid tines tend to close up the previous holes and/or possibly cause some damage if used at the 2"x4" spacing. The sand topdressing was applied before aerifying because any wheel traffic over the area after aerification tends to close up the holes. This post-aerification ban on wheel traffic also meant that the sand had to be swept into the holes by hand.

Once again I was pleased with the short term results. The putting surface was left smooth and the soil conditions were vastly improved by the addition of thousands of columns of sand that were twelve inches deep and ⅞" in diameter. Unfortunately, the wet summer made it difficult to assess any increased rooting or improvement in the health of the turfgrass, so I look forward to next year and what I hope will be sand columns that are full of roots. Would I use the ⅞" solid tines on all of my putting greens? Probably not, but I'm sure glad I gave it a try.

What about my future Verti-Drain plans? Well, I would like to Verti-Drain my putting greens every April and September with ½" solid tines. I'd also like to use it on my old "Push Up" tees and I'd love to see it attack the clay soil in my fairways. Wait a minute, this is getting expensive! Dave will be able to retire just on the profits from North Shore.

Sorry Dave, my plans for 1994 call for the purchase of a Verti-Drain for North Shore. How much are they? Well, to duplicate Dave's unit would take $36,000.00 for both the Verti-Drain and the compact tractor. I should be able to pare that number down to about $24,000.00 by picking up a used tractor. Still a lot of money, but when you consider that Verti-Draining my greens just once a year runs $9,350.00, the payback for this investment is very quick.

My advice to everyone is simple. If you have greens that suffer from a layering problem and/or an "Aerifier Pan" situation, give the Verti-Drain a try. It won't hurt, and I'm willing to bet that it will probably help; maybe a little—maybe a lot. You'll have to discover that for yourself.