

Linear Aerification - Is It For You?

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Putting surface disruption from your core aerification got you down? Sick of the post-aerification whining and complaining from your golf clientele? Then pay attention. There is a new tool on the market that might just find a parking spot next to your core aerifier.

Back in 1990, in Melbourne, Australia, the owners of an engineering factory became frustrated by the poor condition of their municipal cricket pitches. To keep workers employed during an economic slowdown, they designed and manufactured a heavy-duty "ground groover" that could cut through the heavy, compacted soils of their playing fields. The machine was a pronounced success. Soon it was being shipped to many other countries. After some modifications for the softer playing surfaces of a golf course, the Graden GS04 Deep Vertical Mower was displayed at the GCSAA Conference and Show for the first time in the mid-1990's.

This heavy-duty machine resembles the Mataway Seeder but is different in several important respects. The Graden GS04 is outfitted with a variable speed hydrostatic drive to match the conditions you are working in. The cutting blades are spaced on one inch centers, carbide tipped for long life, and available in widths of 1,2,and 3 mm. The machine can cut to a depth of 1.75 inches. It should be noted, in fairness to other manufacturers, that several other deep verticut machines are now on the market.

The southeastern United States was really the first region to utilize and experiment with this type of machine. Acceptance has slowly grown into other areas of the country. So why the sudden interest in this type of machine? With the introduction of the new, high-performance bentgrasses over the past decade, the management of organic matter has become extremely critical. These machines pull out tremendous amounts of organic plant material from the upper soil profile. Depending on blade width and depth setting, these machines can be used for several different situations and end results. Case in point: Pinehurst Resort and C.C. (Pinehurst, N.C.) has G2 bentgrass greens on several of their golf courses. Using Graden vertical mowers, their greens are dethatched every six to eight weeks. A one inch depth setting is used for major organic matter removal. To assist with topdressing incorporation, a shallower setting is used to create channels in the tight, dense canopy of the G2.

Sodded greens can also benefit from the use of this machine if used early in the life of the green. Greens established from sod invariably have issues with layering, whether they are the result of thatch components in the original sod or incompatible root zone media. Aggressive,



2mm Graden Slits Topdresser

deep vertical mowing into the problem area can disrupt and eventually minimize the problem layer, restoring water and air (oxygen) exchange to more acceptable levels. If the problem zone has moved below 1.75" in the soil profile, intense core cultivation is your only remaining option.

What if you manage Pennncross bentgrass greens that were established from seed? Does the Graden or a similar machine have a place in your arsenal? You bet! Without cultural intervention, all sand-based greens will eventually fail. That is the nature of the beast. From the time a sand-based green is established, the soil properties in the upper soil profile begin to change due to the proliferation of new roots, the sloughing of old roots and the accumulation of other plant matter. The accumulation of organic matter slowly plugs the soil macropores, altering the balance in pore spaces. As capillary pore space increases, so does moisture retention in conjunction with reduced infiltration rates and soil oxygen levels. As the process continues, turf quality declines and the soil surface eventually seals up, only to be followed by the eventual failure of the green.

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As golf course superintendents, we head off this process by physically removing the organic matter and incorporating topdressing to dilute the accumulating organic matter. Managing the physical soil properties of the upper soil profile is critical to maintaining quality bentgrass through the stresses of the summer months.

Here at Keller GC, we have been experimenting with the Graden unit for several years now. It was purchased with the original intent of addressing a layering problem in twelve "new" greens. Our problems began in 1990 when twelve greens were rebuilt to USGA standards during an under-funded golf course renovation (12 out of 19 rebuilt). As with most government purchases, low bid determines the vendor. The Penncross sod that was laid over the 80/20 greens mix was of poor quality. It was a mature, thatchy sod. On top of that, the soil that the sod was grown on was incompatible with the 80/20 greens mix. What followed has been years of weak root growth, poor internal drainage, and poor soil aeration, resulting in poor putting surfaces.



3mm Graden Slits

In 1998, we began sending undisturbed soil cores to the International Sports Turf Research Center (ISTRC) in Olathe, Kansas for physical soil analysis. We tested the worst USGA green, #2, against one of our better USGA



Filling the grooves with drag brush.

greens, #18. The results confirmed what we had suspected. Organic content in the upper 1-2 inches of the soil profile was rated extremely high at 2.94-3.26%. The top end of the acceptable organic content range is 2.5%. ISTRC also concluded that with an infiltration rate of .81 inches/hour, #2 green was sealed off. The roots were essentially suffocating. The one inch thick organic sod layer buried in the soil profile was causing problems with perched water tables and limited air and water exchange.

Another issue often overlooked is the accumulation of fines (fine sand, silt and clay) in the upper soil profile. As greens age, contamination is inevitable, whether it be from wind blown material, poor quality topdressing, tracked material, bunker material thrown onto the green or even contamination during construction. According to USGA / ISTRC guidelines, clay, silt, fine sand and very fine sand combined should not total more than 10% of the particle size distribution. Our numbers varied between 12.4 - 13.4% fines in the upper four inches of the soil profile. So in addition to our high organic content, we are also hindered by excessive fines plugging our macropores in the root zone.

After seeing those numbers in the Spring of 1998, we elected to core aerify with three-quarter inch tines two times per year. We continued on this program through the 2000 golf season. We combined the core cultivation with frequent, light topdressings using straight sand throughout the golf season. The golfer response to this program was anything but pleasant. Three-quarter inch holes on the putting surface were not well received and are very slow to heal. We purchased the Graden unit in 2001 and began experimenting.

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In May of this year, we elected to deep verticut all of our putting surfaces in conjunction with one-half inch solid tine aerification. We used the widest blade available at 3mm and cut grooves to a one inch depth. In the past, we used the 2mm blades, which are the most popular blade size, but we found it difficult to incorporate the topdressing sand into the grooves. The 3mm (1/8") groove width was easily filled with straight sand topdressing and surface disruption was kept to a minimum.

We have found that the advantages of deep vertical mowing or "linear aeration" include, but are not limited to:

- + Minimal surface disruption, especially with the 1mm and 2mm blade.

- + Fast recovery with the 2 mm blade; the 3 mm seem to recover quicker than 5/8" tine holes.

- + Using the 3mm blades on one inch centers impacts approximately 14.1% of the putting surface. This compares to 4.9% when using 5/8" hollow tines on 2.5"x 2.5" centers. The 2mm blades impact 7.8% of the surface area. The 1mm blades impact 3.93%.



Graden in Action

- + When done in conjunction with sand topdressing, the process creates sand channels on one inch centers, up to 1.75 inches deep, across the entire putting surface. These channels not only improve surface drainage and air / water permeability, but aggressively manage the organic and "fines" issues we are dealing with.

- + These sand channels will link deep-tine, sand-filled aeration holes that have sealed off at the surface and rejuvenate their effectiveness.

- + This machine will produce an excellent seed bed when bent seed is spread over the topdressing and dragged into the channels.

Deep vertical mowing is surely not a replacement for core cultivation. We intend to core cultivate a minimum of one time per season in the years ahead. Deep vertical mowing is simply another tool to help you deal with organic accumulation and poor physical soil properties that can occur when growing bentgrass on sand-based greens. But the greatest benefit, in the eyes of a golf course superintendent, is the good will this machine will spread for you...no holes equal happy golfers!



Cleaning up the mess.