YEAR THREE — *BEWARE!*

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This is year three of our investigation of the effects of root zone composition on the performance of USGA-type golf putting greens. If our experiences are typical, **beware of year three.**

Before relating what has transpired this season, we need to be aware of the nature of the project and its setting. The research area is a 2,560 ft² putting green constructed according to USGA recommendations. The green is comprised of forty 64 ft² plots isolated from one another by plywood and plastic sheet barriers that extend to the depth of the underlying pea gravel. Ten treatments in the study, each replicated 4 times, consist of root zone mixes prepared with 3 different sands and 7 different amendments (see table below). The putting green is irrigated with 6 Toro 670 heads on 50 ft spacings. The green receives full sunlight and air flow is unobstructed.

One-half of each plot is being trafficked with a drum roller outfitted with golf shoe spikes. This simulates the type of compaction that occurs with a triplex mower and golfer spiking of the putting greens. While it is impossible to say precisely how this trafficking relates to rounds of golf played, our best estimate is that in the past 8 weeks we've simulated daily mowing and 5,000 rounds of golf. The consequences of this and other events are what are being relayed to you in this report.

Many people consider Canadian sphagnum peat to be the premier root zone amendment. We don't necessarily agree. In mid-June we experienced 14 consecutive days without rain, daily maximum temperatures above 90°F and, very often, warm winds out of the southeast. During this period, when the irrigation run time was set to provide 0.25 inches of water each night, one of the Canadian sphagnum plots developed severe localized dry spots. The drought ended with more than 2 inches of rain over a 2-day period, but the dry spots remained. Probing of the root zone in the dry spots revealed that the top inch or so was reasonably moist but beneath was a 3 to 4 inch zone of soil that was so dry that it literally fell out of the soil probe. The entire root zone was moist in surrounding areas that showed no signs of dry spot.

What happened? We think we know. As part of our research this year we're monitoring on a daily basis, in 24 different locations, how much water is actually going on the plots. For three successive days during the dry spell, thanks to the persistent winds and the location of this particular plot, it received less than 0.1 inch of water rather than the 0.25 inches programmed. The plot dried out, the peat became hydrophobic, and localized dry spot reared its ugly head. Why the hydrophobic condition was localized is a complete mystery to us. Regardless, we think this observation sends a signal to those superintendents who deliberately keep putting greens dry on a near continuous basis for the sake of green speed or dry down greens to gain speed for tournaments. You may be the creator of localized dry spot!

Our daily monitoring of watering in 24 locations on this tiny putting green has revealed what many of you already know — there is not an irrigation system in the world that, in the face of constantly varying wind velocity and speed, can uniformly water an entire green. How bad is the uniformity of irrigation? A good coverage on our plots (ie, no wind) resulted in application rates of 0.178 to 0.421 inches and an average only 0.01 inches different than what was programmed. Two days later, irrigation rates ranged from 0.041 to 0.350 inches and the average for the entire green was 0.18 inches, not the 0.25 inches programmed. Strong wind blew a lot of the water away from the green and left some plots badly underwatered.

One might argue that over time these day-to-day variations in water application even out, especially when it rains. When we looked at total water (irrigation + rainfall) received over a 22-day period, the results were disconcerting. The range from one location to another on the putting green was 6.38 to 10.7 inches of water. This clearly shows why hand watering is a vital part of the maintenance of high quality putting greens.

The consequences of surface compaction and daily simulation of golfer traffic for a total of 5,000 rounds are summarized in the table below. Quality of the greens was understandably reduced. But as we've noted in previous years, the amount by which quality is reduced is fairly consistent for the 10 different root zone mixes. Greens constructed with mixes that provide the highest quality before trafficking also provide the highest quality after trafficking.

Surface compaction and its accompanying increase in surface wetness has had a dramatic effect on the amount of algae growth (see table). Even without traffic, algal growth is

Effects of root zone mix composition and simulated traffic on sand putting green quality, algae coverage, presence of localized dry spots and bentgrass thinning.

Sand	Amendment	Quality ratings		Algae coverage		Localized dry spots?	Turf thinning?
		No	Yes*	No	Yes		
				%			
Greensmix	Can. sphagnum	8.2	7.8	3	66	Yes	Yes
	Mich. sphagnum	8.2	7.8	18	69	No	Yes
	Reed sedge	8.2	7.9	6	50	No	Yes
	Wisconsin peat	8.4	8.0	7	49	No	Yes
	Iowa peat	8.3	8.0	6	69	No	Yes
	Rice hulls	7.9	7.5	8	65	Yes	No
	Isolite	8.0	7.2	32	96	Yes	Yes
Janesville	Canadian sphagnum	8.2	7.8	10	69	No	Yes
Bottom ash	Canadian sphagnum	8.2	7.8	4	48	No	No
Greensmix	None	8.0	7.6	7	61	Yes	Yes

* No = no traffic; Yes = traffic.

evident on 3 to 32 percent of the total area of the individual plots. These percentages increased dramatically as a result of trafficking — to as much as 92 percent coverage with algae for the Isolite root zone mix. At this point it is important to recall that these plots are in full sunlight and not tucked in a shaded area. We also need to point out that while the greens are being topdressed with straight sand on regular basis, they have yet to be core cultivated.

Algae growth on the trafficked portions of the plots has been least for the Wisconsin peat and WPL sand treatments. Restricted algae development in the WPL sand treatment may relate to the fact that this root zone mix has a pH of 8.6. We have no explanation as to why the Wisconsin peat root zone mix may be retarding algae growth. We have noted from the volumes of leachate being collected from each green that there seems to be considerably better internal drainage in the Wisconsin peat root zone mix than in any other. Perhaps this promotes surface dry-down and a less hospitable environment for algae growth.

Isolated dry spot has been a problem with the rice hull, Isolite and straight sand root zones from the day they've been constructed. Localized drying in the Canadian sphagnum peat treatment is on but one of the four replications and, as we've pointed out above, arose from a set of somewhat unique circumstances.

Thinning of the 'Penncross' creeping bentgrass on the greens as a result of algae invasion is occurring in isolated spots on all but the rice hull and WPL sand treatments. At this time there does not appear to be a clear relationship between percent of the area of the greens invaded by algae and whether or not turf thinning has occurred.

Now we're faced with some tough decisions. Is algae growth a signal of the need to commence core cultivation? Will a reduction in irrigation rate lead to a reduction in algae without more extensive development of localized dry spots? What role can wetting agents play in dealing with these problems? Comments from those of you who have faced and overcome these problems are most welcome.