Fernando Fernandez, Sr., CGCS

Sand-Based Greens . . .

The Good, The Bad and The Ugly

Fernando Fernandez, Sr. has been working in the golf course industry for 28 years. He started as a laborer and became a superintendent 11 years ago, earning his CGCS seven years ago. He is a turfgrass instructor in two languages (English/ Spanish) and a sand-based greens consultant. Fernando's book, **Sand-Based Greens . . . The Good, The Bad, and The Ugly,** *is available through the GCSAA's bookstore, or through the Web at www.sand-base-greens.com.*

What is good about sand-based greens?

Sand-based greens were supposed to provide many benefits. The list of supposed benefits is extensive:

- Non-compacting.
- Moisture retaining.
- Firm putting surface.
- Consistent green speed.
- Golf ball holding capability.
- Dry putting surface.
- Good percolation rate.
- Healthy turf.
- Plant density.
- Consistency.
- Decreased need for plant protectants.
- Uniformity.

And the list goes on and on . . .

Of all the things reported to be beneficial, the only one that is truly a plus, is that sand-based greens drain well after a big storm . . . they do have a good percolation rate. They can absorb tremendous amounts of precipitation and be playable within a very short period. Other benefits are harder to find.

What is bad about sand-based greens?

The bad things about sand-based greens comprise a list as extensive, if not more so, than the list claiming benefits. Among the unfavorable traits:

- No nutrient retention.
- Wetness (excess moisture retention).
- Footprints (unstable putting surface).
- Accumulation of thatch.
- Problem with ball marks.
- Unhealthy turf.
- Increased need for plant protectants.
- Lack of plant density.
- Leaching (potential contamination of surrounding bodies of water).
- Dynamic (ever-changing).
- Green speed problems.
- Ball-holding capability (either too bouncy or too soft).
- Inconsistency (play differently from day to day, week to week).
- Localized dry spots (fast drying).

(continued on page 18)

- Black layer.
- Algae and moss growth.
- Subsoil competition.
- Temperature-sensitive.
- Short, shallow roots.
- Soil microorganism imbalance.
- Loss of plants' natural immunity and defense system.

What is ugly about sand-based greens?

The ugly thing about sand-based greens is they start out in excellent shape; for the first two to three years, when the greens are new, they perform very well. After that period, depending on how hard they were pushed during their grow-in period, the challenges begin. They start having all kinds of problems, some or most of the ones mentioned in what's bad about sand-based greens above.

It is a very peculiar situation because, given enough time, USGA sand-based greens, California-style sand-based greens, and even push-up greens that have been intensely modified by core removal and the addition of sand, all start acting the same way. They perform very well during the spring and fall—when the weather is cooler—but have problems during the hot periods of the year.

It took 13 years to find out why this situation occurs.

The harder the grow-in period is pushed, the sooner the problems will manifest themselves. USGA, California-style, and push-up greens intensely modified by core removal and addition of sand, when they are four years and older, all start having the same general problems.

When superintendents are asked what challenges they are experiencing, or what concerns they are presented with when managing sand-based greens, most reply, "No problems at all." However, when superintendents are asked what kind of improvements they would like to see for managing their sand-based greens, most reply that they would like to see improvement on some or most of the above-mentioned issues.

The secret!

After 13 years of investigation, the secret was finally revealed: Sand-based greens, and soils of all types, go through change processes throughout the year—changes that are temperature- and biologically-related.

The secret was found, you could say, by accident . . . I was intrigued by the concept of green covers, and began investigating for differences in soil temperature between a green with a green cover on it, and one without it. As a result, I became hooked on taking soil temperatures. During the following year, and for many years thereafter, I took soil temperatures throughout the season. After metering soil temperature for over a decade, a pattern started to materialize. The secret became apparent. It was something so simple, and at the same time as old as nature itself—something never before written or researched. It was something that should have been obvious. The secret is . . . soil temperature inversion.

Problems associated with soil temperature inversion

- Multiple layers of grayish-blue and orange-looking bands, iron sulfide . . . black layer and iron oxide respectively. See figure 1.
- Gases, such as hydrogen sulfide ("rotten egg" odor) and methane, throughout the sand mix profile. See figures 2-A and 2-B.
- An orange-colored mineral deposit, about one-quarter of an inch thick. See figures 3-A and 3-B.
- Mat and thatch rapidly and disproportionately accumulating. See figures 4-A and 4-B.

Figure 1

The green you see in these pictures is 10 years old. This is a USGA green with a choker layer in it. It was cut in half and carved down to the gravel blanket.

Figures 2A-2B

Grayish-blue and orange-looking layers throughout the sand mix's profile.

Figures 3A-3B

The layers were accented in the lower parts of the green.

Hydrogen sulfide gases ("rotten egg" odor) and methane throughout the sand mix profile, and an orange-colored mineral deposit, iron oxide, about one-quarter of an inch thick, mixed in the immediate top part of the choker sand layer, at the interface between the sand mix and the choker sand layer.

Figures 4A-4B

The mineral deposit, as you can see, is strong enough to hold itself together.

Black layer mat and thatch, rapidly and disproportionately accumulating.

Black layer, anaerobic gases and mat and thatch rapidly accumulating have always been a constant challenge for sand-based greens. One thing that represented a particularly shocking discovery is the accumulation of an orange-colored mineral deposit, iron oxide, about 1/4" thick immediately on top of the choker sand layer. This layer creates a sandwich affect, separating the sand mix and the choker sand layer.

To check if your greens have layering problems, take a section of 2.5" PVC irrigation pipe about 2.5' long, cut one end at a 45-degree angle creating a sharp point, and drive it into a green you suspect has layering problems. Make sure it penetrates all the way through the mix, into the clay or whatever parent material there is. Pull it out, cut the pipe in half (lengthwise) with a saw, and look at the soil profile. Make sure you do not hit the green's tile lines. Identify where they are before you drive the pipe in the ground.

Seven steps to correct the problems

1) Eliminate soluble inorganic products.

Salts are, without a doubt, the most damaging factor on sand-based greens, and/or for any kind of soil. Natural organic products, with very low salt indices and leaching potential, are the only ones that should be considered. Care should be taken with animal waste products as most have very high salt indices. Potash, calcium, essential microbiological enzymes, micronutrients and silica are very important constituents of sand-based greens and should always be considered.

2) Flush the root zone.

Flush the root zone at regular intervals long enough so water can be seen running out of the tile

(continued on page 20)

lines. This practice helps the temperature and biological situation in the soil temporarily, and washes away salt build-up (leachates) from fertilizers, pesticides, bicarbonates from irrigation or rainwater, organic residue from biological decomposition, dust and/or air impurities. It gives short-term relief to the plants by removing toxic gases along with salts.

Caution! Flush greens only when you are sure there is a salt and/or toxic gas build-up problem.

3) Use a subair machine.

A subair machine vacuums or blows air into the tile lines of the green. It is a very effective remedy; it removes gases from the stagnant soil's profile of the green, replacing them with fresh ones, without the use of excess water. This practice also helps the temperature and biological situation in the soil temporarily, accomplishing it in a very short period. If done correctly, and all the connections are readily available, it should take only about 15 minutes per green. Six greens can easily be done every morning before the start of play, giving a ventilating rotation of about four days for 20 greens. SubAir is the trade name of SubAir™, Inc.

Having the absolute best, all-around USGA sand-based greens, California-style greens, and push-up greens modified by the removal of cores and addition of sand, requires deep-tine aeration; material injection or drilling to be administered at least twice per year, once in the fall and once in the spring.

4) Perform deep-tine aerating.

Having the absolute best, all-around USGA sand-based greens, California-style greens, and push-up greens modified by the removal of cores and addition of sand, requires deep-tine aeration; material injection or drilling to be administered at least twice per year, once in the fall and once in the spring. The aerating holes should be filled all the way up with an 80-20 mix of the same parent materials the greens were constructed from, incorporating with it a good quality soil amendment.

It is recommended that core aerification with hollow tines, removing the cores and leaving the aerating holes open, during spring or fall, be administered for thatch and/or sand build-up control.

5) Use injection machines.

In the case of USGA greens, California-style and push-up greens modified to sand by the removal of cores and addition of sand, inject with water every two weeks during the summer months.

6) Get thatch under control.

The best way to control thatch is by removing inorganic soluble materials from your program, doing topdressing at regular intervals and aerating with regular hollow tines. Many inorganic soluble materials kill microorganisms that are vital to thatch decomposition.

Note! Eliminating the use of soluble inorganic materials, and incorporating the use of natural organic materials, increases the need for oxygen in the root zone. The use of natural organic and enzymatic materials increases the microorganism activity in the soils; consequently, more oxygen is required throughout the soil profile for their survival. When oxygen is not present in the soil in adequate quantities, anaerobic microorganisms will be predominant, which is not a desirable situation. An aerating program as described above is absolutely necessary.

Using natural organic products requires good aeration in the soil. Good aeration in the soil is a prerequisite regardless of materials used.

Sand greens need to be topdressed once every two weeks. This should be done very lightly so as not to interfere with playing conditions. Use a walk-behind drop or cyclone spreader to reduce weight on the playing surface. Using walk-behind spreaders implies the use of kiln-dry sand.

If not practical to topdress with walk-behind spreaders because of manpower restrictions or the availability of dry sand, consider the use of a pull-behind spreader, which can either be used with dry or wet sand.

It is imperative that thatch be managed and controlled. That in itself will help the green tremendously.

7) Administer soil, water and tissue samples.

Use the services of the USGA Green Section and/or the services of a professional agronomist at least once per year.

To maintain control of changes that may occur in the soil, water, plant protectants, fertilizers, new technologies, and new practices, it is imperative to administer soil, water and tissue samples be at least once a year. The services of the USGA Green Section and the services of a professional agronomist should also be used at least once per year.

The USGA Green Section agronomist will keep you abreast of cutting-edge technologies and practices and provide advice on golf course-related improvements.

Soil, water and tissue samples provide control of plant nutritional needs, soil-related imbalances, microbial populations and/or water-related problems. Some universities throughout the country can perform these tests, or they can be administered by using the services of an independent lab.

If more exacting, step-by-step procedures are desired, so as to provide many additional benefits and provide a means of reducing the use of pesticides, chemical fertilizers, labor and water and decreasing maintenance costs, consider a comprehensive soil analysis. This test should be performed by a professional agronomist (a consultant) to help administer, analyze and implement needed corrections.

Dispelling myths about sand-based greens

Four myths concerning sand greens must be dispelled. The incorrect assumption is that percolation rates, compaction and oxygen availability in the sand medium should not be of concern. The presumption is that a sand green is like a beanbag; it will not compact and there will always be pore space for air and water to move through. In reality, nothing can be further from the truth. Sand greens, if given enough time, will plug up and develop problems with the three things mentioned above. Leachates from fertilizers, pesticides, bicarbonates from irrigation or rainwater, organic residue from biological decomposition, dust and/or air impurities all contribute to this situation. Sand is very temperature-sensitive, and its buffering capacity is very weak, making the entire situation more reactive and complex. It is important to remember that a 10-degrees increase in temperature will double the rate of reaction.

Sand greens, without a doubt, are the best type of greens available today. It is important to realize, however, that they are different. Comparing them to push-up greens is like comparing apples and oranges. They are

(continued on page 36)

Sand greens, without a doubt, are the best type of greens available today. It is important to realize, however, that they are different. Comparing them to push-up greens is like comparing apples and oranges. They are different and must be managed accordingly.

different and must be managed accordingly. Push-up greens modified by core removal and addition of sand are different in their own rank; they perform more like sand greens than push-up greens, and must also be managed accordingly.

Doing what is agronomical and politically correct requires striking a balance between the needs of the golf course, the demands of the golfers and budgetary restraints. The best timing to do deep-tine aerating, and the incorporation of soil amendments, has always been a source of tremendous concern and a hot potato.

To deal with these issues, my recommendation is to consult with your USGA Green Section and/or an independent turf consultant.

Conclusions

Achieving top-quality greens requires following all seven steps outlined above.

However, if budget restrictions prevent the implementation of all seven steps, then do as many of the steps as possible. As a base, the following four steps are absolutely necessary:

1) Eliminate the use of soluble inorganic products. Use natural organic products. Use animal, and animal waste, by-products only if the salt index is very low. Composting and compost products can be used only if not contaminated with sand, silt or clay; antagonistic microorganisms are sterilized, reinoculated with beneficial microbes and then pasteurized.

2) Deep-tine aerate USGA sand greens, California-style and push-up greens modified by the removal of cores and addition of sand, twice per year—once in the fall, and once in the spring. The aerating holes should be filled all the way up with an 80-20 mix of the same parent materials the greens were constructed from, incorporating with it a good quality soil amendment.

3) Topdress lightly, biweekly during the growing season, and core aerate as needed to keep thatch and sand build-up under control to maintain a firm playing surface. It is absolutely necessary.

4) Do soil, water and tissue samples; and use the services of the USGA Green Section, as well as an agronomist or a consultant at least once per year.

These four step are the basic essentials . . . they are absolutely necessary. The other steps, when incorporated also, increase the excellence of the greens exponentially.