THE BLAC

By Jerry Kershasky

This past January, at our National Golf Course Superintendents Association Con ference and Show, there was a special forum on the so-called "Black Layer" that has been seen on many courses across the country.

The forum opened with a panel of four men reviewing their research on the subject. The panel consisted of: Mr. Jonathon Scott, Golf Course Superintendent at the Grand Traverse Resort in Michigan, Dr. Clinton Hodges of Iowa State University, Dr. Curt Brown of Texas A&M University, and Dr. Joe Vargas of Michigan State University.

Mr. Scott opened the discussion describing his course which was built in 1983 with U.S.G.A. spec. greens. In 1986 three of Mr. Scott's greens, which were in a heavily wooded and low area on the course, turned brown in sections and died. He sent off the usual samples to the local university extension service for disease, nematode, and insect analysis, but all returned negative. He had noticed when he took the samples that a once healthy 10" root system was now all but nonexistent, and that a foul odor was being emitted from a black layer in the greens mix about one inch from the surface.

Mr. Scott also noticed, after an unusually wet summer, that these greens, which had excellent percolation rates the first two years, had difficulty absorbing 1/10" of rain now.

At this point Mr. Scott was well into investigating the problem. Because of the poor drainage he thought he might have a plugged drain tile, so he flushed all lines and found all of them to be in perfect operating condition.

His next thought was that possibly the water table around these greens might have risen, causing water to back up in the tiles at times. He brought in an auger and drilled holes around the perimeter of these greens, but found nothing abnormal.

He did note, however, that after a rain if he stuck a soil probe into a puddle on the green and pushed it through the black layer and then extracted it, the puddle would drain just as if you pulled the plug on a bath tub. This example led him to believe his greens were properly constructed beneath the layer and indeed his drain tile was functioning and the water table was having no effect on drainage.

He proceeded on to check the shade factor on these greens, but after day long surveys he found direct sunlight was quite adequate.

During this period he had also lost a couple of approaches to the same problem. This led him to believe it might be contaminated soil, so he dug out the approaches and placed new soil in, but this did not help; the turf died anyway.

He went on further, thinking that stagnant air around these greens might be causing the problem. He started thinning out trees and cutting out brush undergrowth around these greens. He is still in this process, so he will not know the results until next season.

A couple of other interesting facts must be mentioned here. One is that he resodded areas on these greens with turf from his nursery, and so far it appears healthy without any problems. Let's note here that the variety of grass was the same on the infected greens and the nursery, but the fertility practice was somewhat different, and I'll refer back to this difference after I review with you the other panel members' thoughts and theories.

The other facts of note were that in high traffic areas the problem was worse, and that frequent topdressing also aggravated the problem, but frequent aerification (as much as once per week) improved the turf.

Dr. Hodges first noticed the problem in 1978, and on all samples he has received, be they from any part of the country, he has been able to identify one of three algae organisms in all samples.

On most of the greens he has observed layers forming on the surface or anywhere from ¼" to 7" down in the mix profile. He has also noticed these algae forming balls or circular shapes in the profile.

The algae causes both a physical and chemical problem. The physical problem occurs because of the way they move - that's right, these algae are mobile. They excrete mucous which propels them across the surface and allows them to cover a whole green laterally. The algae organism itself is not good, but the deposited mucous it leaves behind might be a good substitute for super glue or any other type of sealant. This mucous adheres so tightly together that water or any other element you would like to have penetrate the surface has one hell of a time doing it. Fungicides applied at this point may stop the progress of the algae but it won't remove that sticky mucous; that has to be physically removed before proper water movement can be restored.

Once this barrier of algae and its mucous has been formed, what happens next is really a matter of chance. For example, the green might receive several days of rain which will cause a perched water table above this layer. The water will fill the pore spaces pushing out oxygen; the algae, of course, are using oxygen in their life cycle and very soon you will have set up a anaerobic condition that the roots of grass plants can't survive. And per chance they do hang on Dr. Hodges has isolated a pythium organism that has adapted to this anaerobic condition so the roots that are now in a weakened state could fall victim to this pythium.

Another interesting experiment Dr. Hodges ran was placing a calcareous sand in one beaker and a silica sand in another, and inoculating the sands with the algae organisms. In a few short days the calcareous sand had algae growing profusely in it and the silica sand had little, if any, algae in it.

Dr. Brown conducts soil physical analysis for greens mixes and other types of construction mixes. He first saw the problem in the early 1980s' when samples that were approved for greens construction from his lab came back to him with a black layer problem. He retested the samples and the physical components were still ok. He concludes that the water movement problem in these greens is not a soil mix problem, but an organic problem. He believes the organics are producing sulfur, (hydrogen sulfide) and that indeed, if left unchecked for years (that's a lot of years), this would end up forming pyrite.

Dr. Brown suggests the following practices to minimize your chances of developing the problem:

1. When constructing a green, make sure your base has no low areas that will form pockets of water that will not

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drain toward tiles.
2. Make sure your top mix is a consistent depth. If you have 10" in one area of the green and 6" in another, the 6" area is going to be wet.
3. Surface drainage must be positive, no pockets. Pocketed areas on greens have had the worst problem with this disorder.
4. Excess thatch may be a key in causing the problem, and buried thatch contributes to the problem.
5. Avoid over-watering.
6. Avoid over-fertilizing.
7. Minimize the use of pesticides.

If you have a problem, how do you deal with it? According to Dr. Brown:
1. Aerate, remove and destroy the cores. Don't topdress or build something with these cores.
2. Fill holes with sand.
3. Inject air into greens by installaing perforated pipe every 6" and forcing compressed air into the soil profile. (rather expensive).
4. Ph should be 7.
5. Minimize irrigation.
6. Minimize nitrogen fertilizer.
7. Remove thatch.
8. Decrease topdressing; it will bury the problem, making it worse.
9. Pray it doesn't rain; you want control of the watering.
10. Remove turf and resod.

Dr. Vargas first saw the problem six years ago. He doesn't think its caused by algae, pythium, excess water, high ph, or high amounts of N, but rather by an accumulation of sulfides in the soil.

Dr. Vargas went on to explain the chemical conversion of sulfur and iron sulfate to hydrogen sulfide which this stenographer was unable to record in the time the slide was on the screen. But in essence, what was occuring was the excess hydrogen sulfide was a contributing factor in producing an anaerobic condition in the soil. And as we all know, metal sulfides turn black, thus the color of the black layer. In all of Dr. Vargas's samples of the problem, he found excess amounts of sulfur and iron on the black layer greens, and less of these elements on healthy greens he sampled from the same course.

Dr. Vargas was also able to induce a black layer in a week's time by applying five pounds of elemental sulfur and some iron sulfate to a sand in the lab. The check had no black layer, although all conditions except the sulfur and iron were the same.

Now let's get back to the difference in fertility practices of Mr. Scott. Remember, his nursery did not have the problem but a few of his playing greens did. When he sodded some of the bad areas of these greens with the nursery turf, the nursery turf survived, and root depth increased under it. The difference in Mr. Scott's fertilizer program was sulfur. He was applying sulfur to reduce his high ph on the greens, but as we all do at times, he did not make nearly as many applications to his nursery.

Now my friends, all this which I have just written is new research, and none of these men have come out with, at this early stage of study, a concrete, no doubt about it, this is the problem, and this is what you need to do to solve it, for sure. All these men say they need more time to study the variables and test various theories before they can be conclusive. But as you and I know as turf managers, we have to take what data is available at this time, evaluate it, and if we so deem necessary, work the variables into our program, if for no other reason than to buy time for our researchers to find answers, before we have major problems on our turf.

By the way, when the audience at this panel discussion was asked if they had seen a black layer on their course, three fourths of them raised their hands. The audience was a cross section of turf managers from the east coast to the west coast and numbered about 400.

The following question and answer was taken word for word directly from the back page of the U.S.G.A. Greens Section Record, January/February 1987.

THE BLACK LAYER
Question: This past summer I heard a lot of talk about what some say is a new putting green disease called "the black layer". It usually appears in the soils of greens, even USGA spec greens, usually about two or three inches below the surface, has a swampy odor, and the grass roots and plants die. What do you know about it? (Indiana)

Answer: Enough to say it's not a disease and is not even associated with a disease. At least no causative pathogen had ever been identified. The so-called "Black Layer" has been around a long time. (See USGA Green Section Record, July 1970, "Solving Drainage Problems at El Macero", by Dr. D.W. Henderson, Dr. D.T. Bradley, University of California, Davis,, and J. Jagur, Superintendent, El Macero C.C.)

It is, pure and simple, an irrigation problem or a drainage problem or both, depending upon how one wants to look at it. The soils become too wet for too long. The swampy odor attests to that fact. Dry out the soil profile, and the Black Layer (and odor) disappear.

Even sandy soils and USGA spec greens can become too wet and compacted (in particular zones) if there was a poor or incorrect soil mix, incorrect construction, a migration of silt or other fine particles into a layer, poor internal tile drainage techniques, etc.

With insufficient soil permeability and continued rains and/or unrelenting irrigation, all pore spaces become saturated with water to the exclusion of air (oxygen). Couple this with warm summer soil temperatures and the presence of some organic matter, and anaerobic processes, indicated by the blue-black color and foul smell, naturally set in. Normal growth requirements are destroyed, and the plant dies.

How to correct or prevent the phenomenon? Step one is to drastically curtail or stop all irrigation, including syringing. Dry out the green. Aerify, spike or slice, even in the middle of summer. Get air back into the rootzone. Syringe only when moderate to severe blue wilt or footprinting develops, and even then syringe only for a minute or two over the entire green. Do not irrigate. It may be several days or even weeks (depending on climatic conditions) before new irrigation is needed. There must be a longer period for drainage between future irrigations. A very light dusting (two pounds per 1,000 square feet) of hydrated lime following aeration or spiking may also be helpful.

As Professor L. S. Dickinson once said, "Help the little grass plant grow. Don't try to make it grow." Words of wisdom.

Is this answer an easy solution to a complex problem?