Renovated 18th fairway (above) in 1988 with improved couch cover. Same fairway in 1986 (right) devastated by Pythium.

began *Poa annua* control with ethofumesate (Prograss) and performed regular grooming (verticutting) every two to three weeks. With the onset of winter, recovery slowed, and this work was discontinued until growth resumed in the spring. Topdressing was done only after verticutting or coring to minimize buildup of layers.

Later that summer, nine more greens were rebuilt. Three of them were turfed with sod from the nursery and the other six received sod cut at 1/2 inch depth from the old greens.

These six "new greens with old turf" were severely infested with Poa. Several applications of Endothal, some at twice the recommended rate, only weakened the Poa temporarily. Practically every plant grew back.

All of this presented only two options: to accept the results and continue with mediocre turf quality, or to try and improve the situation. I chose the latter.

The following winter, or the summer of '86 to those of you in North America, I observed that the thatch buildup on the renovated greens was following a path similar to that of the old greens. The layer of thatch was almost one inch thick on the first set of rebuilt greens and 3/4 inch on the second set. In both cases, the thatch possessed the same color, texture and smell.

It appeared that the capillary forces in the thatch were creating a perched water table (a layer which must be saturated with water before drainage can take place) and were reducing air movement through the soil. This seemed to prevent toxic gases created by the anaerobic decomposition process from escaping the soil, and I assumed that was damaging the turf.

To combat this, I requested funding for a set of spiking attachments for the greensmower to penetrate the layer. Unfortunately the club did not understand the gravity of the situation and my request was denied. It was also difficult to gain permission to core aerify, and it took 15 months to persuade the green committee that this was a necessary disruption of play. Obviously, a great deal of education was required to gain the club's confidence in proper agronomic procedures.

Once aerification began, I observed that algal material was a main constituent of the thatch and mat under my greens, tees and fairways. Contrary to the expected results from the coring, this material seemed to grow even deeper into the core holes—yet another sign that something was terribly wrong with Wanneroo's turfgrass.

In an attempt to gain some measure of control over an ever worsening situation, I applied water very sparingly. This caused some of the members to complain that the greens were too hard. Others thought that my daily syringes to cool the turf on the root-shortened greens were encouraging the growth of algae.

While I was trying to walk this very delicate tightrope to satisfy both factions and still fight my problem, I began to lose turf in September 1986. Two-thirds of one green and smaller areas of several other greens had to be re-turfed. Conditions continued to deteriorate. I knew some drastic measures would have to be taken to save my turf, and ultimately, my job.

The culprit turned out to be the black layer syndrome. Through corrective measures, by 1988 I had completely reversed the situation at Wanneroo. After a recent coring and topdressing of the greens, no algae was present. Within ten days all of the core holes were covered with turf. Roots were down four to eight inches and the general health of the turf was greatly improved.

This turnaround was accomplished by establishing a management theory summed up as "Beware of Algae in Turfgrass" and taking steps to either reduce or eliminate the problem.

The first step was to find an acceptable algaecide to use on turf without phytotoxicity. I found one that was being used in swimming pools. It contains low levels of a particular form of chelated copper rather than the more commonly used copper sulfate, which is toxic to turf. I also developed an elementary chlorinator for my irrigation system, which helped me with the task of controlling the blue-green algae, an organism with photosynthetic and nitrogen fixing properties. Combined with the proper soil management techniques of coring, spiking and verticutting, results were fantastic.

I now faced an interesting question: Was the algae growing on the Wanneroo Golf Course created by poor management practices of the past, or was there another element?

At first I believed the compacted thatch and soil was the sole culprit. However, I had seen crusts of algae growing on bare, white sand. This crust increased in a matter of weeks to a layer one inch thick. It had the consistency of rubber and seemed to induce anaerobic conditions.

In this case, no waterlogging took place. There were no drainage problems, and the only possible source appeared to be the filthy irrigation water. It is my belief that a continuous resupply of algal organisms from the irrigation water induced poor air exchange in the thatch and root zone. The resulting anaerobic condition caused the bacteria in the soil to create the black layer.

Further support of this theory came from my observations that the mucus produced by algae creates a dense, watertight barrier which leads to "dry patch" or isolated dry

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Localized dry patches on 17th fairway in 1986.

Renovation Down Under

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spots. This often occurs in Perth at the end of winter, when the sun becomes warmer and wind dries the greens surfaces over a weekend, taking many superintendents by surprise.

Dr. Clinton Hodges of Iowa State University had similar observations. His articles in various turf publications have been a great help and support to me throughout this period. Similarly, Jonathon Scott had experienced some of the same problems at Grand Traverse Resort in northern Michigan. He generously assisted me with information and a professional kinship not easily found in Australia. It was a great comfort to know that I was not alone with my problems.

Thatch was also a major problem on the fairways. The course was 12 years old when I started to renovate the fairways. The initial cover of common couch, or bermuda, had been invaded by *Poa annua,* water couch, Paspalum, and numerous other weeds which thrive in compacted and waterlogged soils. As a result, crabgrass dominated the heat-stressed Poa every summer, leaving little chance for the couch to grow.

The thatch was up to three inches thick in places supporting a pH of 4.2 to 4.5. It was very water repellent and caused numerous dry spots to appear during hot summer afternoons. In the winter, the thatch became waterlogged and quite anaerobic, further weakening the dormant couch grass. Algae was also abundant during the winter, making the situation chronic.

Again, I had two choices. One was to encourage more Poa, which ultimately meant more thatch and crabgrass. The second was to encourage the couch grasses living in a state of semi-dormancy in the mat. I chose the second, knowing full well that I would be hampered by my inadequate irrigation system.

We began spreading calcareous sand from a shellfish deposit to raise the pH of the fairways. Over three years we used more than 1.3 American tons per acre of the sand, rated at 93 percent $CaCO_3$3 and 1.5 percent Mg.

Next I cored the fairways with a Ryan Tracaire, getting poor penetration in the compacted dry areas. Initially, this coring severely damaged the heat-stressed Poa, leaving the golfers very displeased. We followed with a Gallagher flail mower fitted with dethatching blades set to a depth of 3/4 to one inch. Needless to say, we proceeded very slowly!

The couch started fighting back and filling the gaps left by the dying Poa, though crabgrass was competing for the same space. Unfortunately, the cost of rebuilding the greens left little money available for herbicide treatments to keep the crab in check.

Another problem in the fairways was black beetle infestation. This was due in part to the excessive watering that had taken place at Wanneroo before 1984. Deep, infrequent irrigation helped keep beetle numbers down, reducing the need for frequent insecticide applications. The worm population began to flourish, breaking down the thatch layer and aerating the soil. By 1988, the thatch mat had become a decomposed layer of humus.

The fertilizer program for the fairways was continuously modified to fit the increasing couch grass requirements, particularly using higher potassium levels. Unfortunately, water repellency was too severe due to the thatch and fungal mat, and the couch recovery was not ideal. In the winter Poa became dominant, further stressing the couch. I found myself having to limit fertilization in order to starve the Poa.

Spring and early summer of 1986 were fairly humid. The fairways began to release a very strong fungal smell, especially when we cored and verticut. In October and November (late spring in Australia) wide areas of fairways were destroyed by a fungus later identified as *Pythium.* It was gratifying that the couch was not affected and quickly filled the voids left by the damaged Poa.

However, bacterial slime grew on the dead plants, adding to the smell and ugly appearance of the fairways. This explosion of saprophytic activity was obviously the result of the liming and repeated aeration. For me, it was a sign of progress. But for the greens committee and most golfers, it was a sign that the course was dying. While I professed to be attacking the fungal problem, I secretly cherished and nurtured it.

By the end of the summer of 1986, most fairways supported an 80-percent couch cover. My plan for 1987 was to continue to use the fungus to my advantage. I would suppress the Poa earlier, allowing the couch to profit from the whole growing season. . .and watch the fungus do the cleanup.

For the last three years I had cultivated a healthier couch population, and now I was ready to play my trump card with the greens committee. My plan was to treat all fairways with Roundup at a rate which would not injure the couch. I had experimented with Atrazine, Roundup and Tryquat to find a rate that would eradicate the Poa and other cool season grasses and broadleaf weeds without damaging the couch.

After a great deal of argument, I was allowed to proceed. Within two weeks the undesirable weeds and grasses were dying.

What I didn't want, however, was to add to the decomposition problem. I had experimented with a propane burner built by a gas company for the purpose of weed control and thatch burning. I learned that a speed of about six mph would burn off the dead leaf tissue without harming the couch. Unfortunately, the unit was destroyed in an accident in transit to the club. I still believe that the principle is sound and will definitely use this machine in the future.

Without burning, it took several weeks for the dead organic matter to decompose, even after several corings and verticuttings.

My funds were low, but I wanted to spray the fairways and primary roughs with wetting agent. My chemical supplier mentioned that band applications at low rates of Wettasoil, a popular wetting agent in Australia, were successful in wheat growing. Of course, if funds were available, I would have opted for full coverage.

The sprayer was calibrated to the proper coverage, using four-inch spacing, with the fan nozzles of the spray boom directed almost perpendicular to the surface. The results were remarkable. The color of the fairways improved within days, and irrigation spread the wetting agent into the soil between the bands. In the rough, where less irrigation reached, green stripes appeared for a few weeks, showing the efficiency of the product.

To speed the recovery of the couch, my fertilization technique was changed once more. Foliar sprays of urea mixed with muriate of potash, iron sulfate, and other micronutrients replaced granular applications of ammonium nitrate. Applications every two to three weeks encouraged couch growth and made more efficient use of the nutrients possible.

The foliar sprays had another advantage. According to Dr. V. Stewart, a Welsh soil expert, ammonium nitrate is detrimental to earthworms, which I was trying desperately to reintroduce to my soils.

Soil profile shows dark, foul-smelling layer beneath surface.

Finally, I was growing pure couch instead of helping the Poa and other undesirable weeds compete. Still, usually cool, dry weather in the early part of the summer of 1987-88 allowed more Poa to germinate. This forced reapplication of Roundup and left an opening for crabgrass. It took several applications of MSMA to eliminate the crabgrass.

A third treatment with Roundup was made in early February, followed by Kerb in March and a very light rate of Atrazine on several fairways to control Poa germination. Last year the Poa was back under control.

Coring is essential to couch growth at Wanneroo, since there remains a dense barrier of humus composed of the earlier thatch and mat. This could easily lead to anaerobic conditions in a wet winter and

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Propane burner used as an experiment to burn off thatch and kill fungi on fairway.

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must be watched carefully. Perhaps in the future, sand topdressing can help alleviate this situation and improve the smoothness of the fairways.

None of the renovation at Wanneroo could have been possible had I not also solved the irrigation problems. At one time, the entire PVC piping system was partially clogged with bacterial and algal growth. It was so filled with this organic mulch that some pipes allowed only 15 psi at the sprinkler head.

I had no idea how to begin to clean the system, save pulling new pipe and starting over. A clue came from efforts to clear the irrigation reservoir of years of algal mud and bacteria as well as the effectiveness of treatments with algaecide and chlorine to the greens. During this process the pipes seemed to be unclogging!

I had stumbled upon a method that would work without injury to the turf. By injecting a weak chlorine solution through the pump system every third to fifth week, and algaecide injections three to four times a year, my pipes are now free of organic buildup. The irrigation system is operating efficiently once again.

There are still a multitude of doubters waiting for me to fail in my quest to grow pure couch fairways and good greens at Wanneroo Golf Club. The facts are that given a difficult history of mismanagement, the grass never had a chance.

Replacing a smelly heap of thatch and weeds, there are now beautiful couch fairways and smoother, healthier greens for the golfers to enjoy. Furthermore, the close roughs have benefited from this program and the planned overseeding of these areas was unnecessary.

The entire task would have been doubtful had I not held a firm belief in myself and my profession. In Australia, as well as anywhere, you must stand by your commitment to success and strive for perfection.

I have learned a great deal from my work at Wanneroo and appreciate the opportunity to share my experiences with my American colleagues.

ADDISON WINS GOLD MEDAL FOR PARK DEVELOPMENT

The Texas Recreational and Park Society recently honored the Town of Addison with its gold medal for excellence in park and recreational management. The town was judged best in the state among cities with less than 60,000 population.

Slade Strickland, director of landscape development for the Dennison's parks and recreation department, said he has learned to utilize the value of any small piece of land within the town's 4.5 square miles. Through his leadership, Dennison has developed new parks, landscaped the medians and highway entrances, and improved two large recreational centers.

"We are very proud of our parks and recreation department," said city manager Ron Whitehead. "One of our goals for the community is to break up the sea of concrete that can exist in an urban center by planting and designing recreational parks. Our residents wanted more space for recreation and we are working hard to develop new areas and answer their needs."

Whitehead cites as an example, the development of power easements into functional jogging trails with landscaped rest areas.

The town cooperates with Trinity Christian College, a local school, to provide residents with a lighted track, tennis courts, playgrounds, and softball, football and soccer fields. In exchange for use of the school facilities after hours and on weekends, the park department has made several improvements to the property and maintains it throughout the year.

ZAJAC LAUNCHES SEED MARKETING AND DEVELOPMENT FIRM

John Zajac, a 17-year veteran of the turf seed industry and former president of Garfield Williamson in Fairfield, NJ, has created a new company to develop and market improved turfgrass varieties.

The company, Zajac Performance Seeds, purchased Garfield Williamson's line of proprietary turfgrass varieties this past winter. It will market these existing varieties for distribution by regional seed companies and develop new varieties to meet the needs of turf managers in these regions.

"Having been in the distribution end of the turf business for 17 years, I am driven by those challenges," explained Zajac. "There has been a trend during the past five years to select and market turfgrass varieties which perform well in certain regions of the country. We have customized our business to help seed companies meet the specialized needs of their customers."

Zajac sites as examples the need for snow mold tolerant varieties in the Northeast and stem rust resistant varieties of perennial ryegrasses in the Southwest.

The company currently markets Jaguar I and Jaguar II turf-type tall fescues, Omega II perennial ryegrass, Saturn perennial ryegrass, and Liberty Kentucky bluegrass. Emperor dwarf tall fescue will be introduced this fall and Vista red fescue is scheduled for release in 1990.

"These and future varieties now in development are targeted to meet the demanding requirements of our customers' needs, both nationally and internationally," Zajac remarked. The new company is based in North Haledon, NJ.

FOUNDATION APPOINTS GRAU LIFE CHAIRMAN

The Musser International Turfgrass Foundation (MITF) has honored Dr. Fred Grau with the title Honorary Life Chairman. Grau recently stepped down after 20 years as executive director of the group.

Frank Dobie, general manager of Sharon Golf Club in Sharon Center, OH, is the president of MITF. Much of the money for the endowment has been raised by MITF golf tournaments. Superintendents interested in raising money to support turf research can contact Dobie, (216) 239-2383.

CHALKBOARD

TIPS FROM THE PROS

WATER FILTERS GUARD TODAY'S IRRIGATION SYSTEMS

By Efraim Donitz

As water becomes more precious and irrigation systems increase in complexity and automation, the importance of water filters grows in the golf and sports turf industry.

Whether treated or untreated, water is not the only substance carried by pipes throughout irrigation systems. Particles, just a few microns wide, in flowing water can plug nozzles, damage pumps or plug valves. Any disruption in flow or distribution upsets the careful metering of water to acres of turf and landscape plantings.

There are two kinds of impurities in water, chemical and physical. Filters in general remove only physical impurities.

As a rule, water should be tested to determine the type of impurity so you can select the proper filter to remove it. A simple jar test can give you an idea of the type of impurity in your water supply. Open a valve and let water flow for a few seconds before filling a jar. Let the jar sit for 24 hours. Sand, gravel or silt will settle to the bottom, while organic matter will float to the top, since it is light than water.

An important point to understand is that no single type of filter will eliminate all impurities. There are three basic types: screen filters, sand separators, and media filters. Each solves a particular problem.

Screen filters eliminate particles that are bigger than the size of the mesh of the screen. In my opinion, this type of filter should be on every installation.

Typical mesh ranges for irrigation systems are 40 to 80 mesh for most turf sprinkler heads and 80 to 150 mesh for drip emitters. The openings in 40 mesh screen are 435 microns wide compared to 178 microns for those of 80 mesh screen. Remember that pressure loss increases as the size of the openings in the mesh decreases. You need to find a happy medium between pressure loss and the size of particle you are trying to eliminate.

The next type of filter is the sand separator or hydrocylone filter. It has the ability to remove particles that are heavier than water. This type of filter is very important when the water is coming from wells. It is especially valuable during the later months of the summer when the water is pumped from lower strata which have more sand in them. This filter is also very effective with metropolitan water that is rich in sand and gravel.

The third type is the media filter. It is necessary whenever irrigation water is pumped from ponds or reservoirs which contain organic material. Make sure to select a media filter that is designed for the flow rate of your system. Sand is often the media contained in these filters.

Three-barrel media filter capable of 800 gallons per minute. Photo courtesy: Efco.

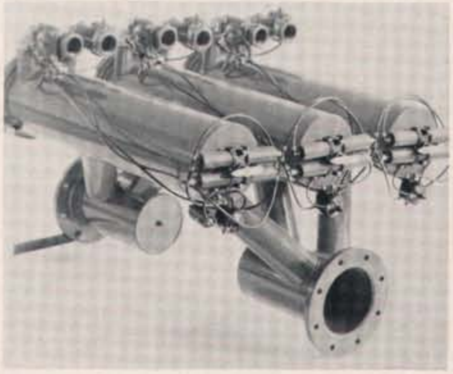
Depending upon your needs, these three basic filters can be used alone or in combinations. A popular manufactured combination filter is the circulating or spin filter. It is actually a screen filter with a sand separator and has the ability to eliminate all particles that are heavier than water, as well as all particles that are bigger than the mesh of the screen.

This filter offers the greatest amount of impurity elimination per dollar invested, and yet it doesn't occupy very much space. It can be used in place of a media filter, and has the added benefit of cleaning itself automatically, which is very important.

Before choosing a filter, first determine the type of impurity in the water and the quantity of that impurity. Then you will want to determine the flow requirement of the irrigation system so that you'll know what capacity of filter is needed.

Next you have to know the required filtration—in other words, what are the sizes of the nozzles in the irrigation system—so that you can choose the right mesh to eliminate particles which will clog that particular system. Then you need to know the maximum and minimum water pressures required by the system.

Finally you need to determine any future changes, whether they be increases or decreases in volume. Filters must have the capacity to handle the greatest possible volume.



Automatic screen filter. Photo courtesy: Amiad U.S.A.

A few examples of matching filters to impurities will help explain the process of selecting the right type and size of filter.

Physical impurity number one is sand, which is common in metropolitan water supplies and in water coming from wells. Sand can be eliminated by hydrocyclone separators or sand separators, or by circulating filters. Still, such treatment should be followed by a screen filter. I firmly believe that screen filters offer a necessary insurance policy.

The second common type of impurity is suspended organic matter such as algae. This impurity can be eliminated by media (sand) filters, not to be confused with sand separators. Organic suspended matter can also be eliminated to a great degree by using circulating filters, especially when the sprinklers have large-enough nozzles.

When using media filters, it is important to follow them in line with screen backwash filters, which are built to filter both ways—from the outside and the inside, or the upstream and downstream side.

The third category of impurities consists of silt, organic matter, solids, and large quantities of algae. In this case, you should put a hydrocyclone separator first in line. In the worst cases, it should be followed by a media filter. In not-so-severe cases, it could be followed instead by a circulating filter.

Let's say that we have a pond or reservoir filled with reclaimed water, which is growing a tremendous "soup" of algae, and we have to filter that water. In such a case, we would have to use both hydrocyclone and media filters in combination.

On the other hand, let's say we have a canal or river, which transfers water from point A to point B, and we are in the middle. The impurities in this water are changing all the time. In this case we could use a hydrocyclone separator, followed by a circulating filter or two, depending on the situation.

Now let's go to the fourth type of impurity—clay, either with or without organic matter. In this case we must use media filters with very fine sand media, followed by a circulating filter as a control filter.

Special attention has to be given to the flow rate inside the media filter itself, which should be relatively low. Let me explain that.

The water has to move very slowly through the media to discharge the clay particles, which are very, very tiny. In other words, let's say we have a media filter which has the ability to discharge 200 gpm. We would use it to discharge only 75 gpm. Therefore we are using a low flow inside the media filter.

Hydrocyclone filter. Photo courtesy: Efco.

The circulating filter that follows the media filter should be working at full capacity. In the example that I just gave, the circulating filter should be working at 75 gpm, which is indeed its full capacity.

And now we get to the type of water that will probably have the most interest golf course and park superintendents. This is reycled water, which contains the sixth type of impurity we will discuss: recycled sewage effluent.

It is recommended that each case here be considered separately, according to climate, the amount of chlorine in the water, and the degree of treatment that has already been applied to clean the water. But as a general rule, media filters at maximum flow, followed by circulating filters at the correct flow rate, constitute a good starting point for cleaning recycled water.

These are a few examples of the various types of filtration that should be used in removing specific impurities from water that will be utilized in institutional irrigation systems.

One point to remember in today's world is that a large amount of scarce, expensive labor goes into cleaning sprinklers. This labor can be eliminated by using proper filtration on the water in the first place.

With low-volume systems becoming popular, the nozzles are getting smaller. So proper filtration becomes correspondingly more important to the sports turf manager.

Editor's Note: Efraim Donitz is an irrigation consultant and the president of EFCO, Inc., North Hollywood, CA. The company makes all types of filters for both landscape and agriculture.

ROOKIES

PRODUCT UPDATE

LIGHT WEIGHT, FOUR-WHEEL DRIVE MOWER

With on-demand four-wheel drive the Jacobsen LF-100 five-gang fairway mower can climb hills without damaging turf from wheel spin and slippage.

At the touch of a knob, the operator can go from two- to four-wheel drive and back, without stopping.

The five 22-inch reels provide a 100-inch cut. This, in addition to mowing speeds of more than five mph, means high productivity. The up-front placement of the outside reels allows the operator to see the trimming edge without looking behind for a cleaner mowing line.

A pedal-operated reel lift helps the operator crosscut fairways effectively. A tight turning radius and power steering provide extra maneuverability and comfort.

JACOBSEN TURF EQUIPMENT

Circle **133** on Postage Free Card

SLOW-RELEASE FERTILIZER

Coron's amine-modified Polymethylene urea nitrogen fertilizer solution is a clear liquid, storage stable, 28-0-0 solution.

The fertilizer is manufactured by a two-stage reaction method that uses buffering materials to maintain the solution at a constant near neutral pH. This, along with the absence of harmful free ammonia, makes it safe for those who must physically handle the product.

The slowly releasing nitrogen and non-burning characteristics make the fertilizer safe for use in high concentrations on turf and in foliage-feeding situations on ornamentals.

CORON CORPORATION

Circle **134** on Postage Free Card

PENDULAR SPREADER

The Turbo Hop from Befco is a pendular spreader that is ideal for golf course applications.

The infinitely adjustable arc of spread allows a swath width adjustment from 20 to 66 feet. Multiple flow settings with instant on-off control make calibration easy for any speed or spreading width.

Features include a durable anti-shock polyethylene hopper, strong steel-tubing frame, cast-steel anti-wear agitator, heavy-