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Cover Photo:
Even small equipment can be leased as part of a package.

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What type of trade-in value does this have?

Equipment Replacement: Choosing a Path of "Leased" Resistance

by GEORGE B. MANUEL
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FOR A GOLF COURSE to reach its potential, everyone knows that good agronomic and cultural practices must be employed. Although these practices vary from course to course and from one part of the country to another, there is at least one factor that remains constant: Turf quality is greatly enhanced through the use of modern equipment.

There have been tremendous changes in the machinery used on courses over the years. Some are technological advances such as lightweight mowers for fairways or water injection aerifiers, while others represent a return to practices of the past, such as the use of walk-behind greens mowers.

By virtue of their experience with thousands of golf courses across the country, USGA agronomists have developed a rule of thumb for funding the replacement of maintenance equipment. Assuming the equipment inventory has been kept current, 10 to 15 percent of the total replacement value should be spent toward the purchase of new machinery each season. For an average course, this would equate to $35,000 to $50,000 per year. Unfortunately, many courses have found it difficult, if not impossible, to make vital capital equipment purchases for the past several years. As a result, much of their machinery is long overdue for replacement. This has a domino effect on other aspects of course mainte-

Leasing can be advantageous when you need a piece of equipment for a special project.

nance. The cost of equipment maintenance skyrockets and, due to the need for frequent repair, the machinery suffers unnecessary "down time." While waiting for parts, the golf course staff's efficiency is reduced, resulting in a less well kept facility. Ultimately, players begin to notice the drop in quality, and criticism is directed at the golf course superintendent.

Remember, the rule of thumb mentioned previously is appropriate when the equipment inventory has been kept current. Unfortunately, far too many clubs fail to purchase equipment on such a timely basis, and before long much of the inventory is due for replacement. When this situation occurs, what options does a golf facility have? While attempting to "catch up" in a single season has its merits, it is the rare board of directors that has the strength or desire to assess a membership for so much new equipment, even when it is badly needed.

Fortunately, there is a good alternative that can provide relief for many courses. Rather than purchasing various big-ticket items in a single season, courses instead are choosing to lease their entire inventory for approximately four to five years. At the end of the lease, the equipment can be purchased or turned back to the lessor and the process begins all over again.

As mentioned earlier, the new equipment used on courses today is much different than it was just five to ten years ago. Fairways, tees, and greens are all being mowed with lighter-weight, less-expensive equipment. However, because of these two factors, their life expectancy is not nearly as long. For example, consider the options on fairway mowing equipment. A lightweight mower provides a higher-quality cut, produces less compaction and wear damage, and gives a more distinct mowing pattern than its predecessor, the large and heavy tractor unit. But instead of 10 to 15 years of useful service, the lighter unit provides just six to seven years of service. After this period the mower probably will wind up in that old equipment graveyard so familiar to most courses.

That brings up another point. How many courses actually trade in equipment? What is the value after six or seven years of service? Unfortunately, it probably is worth very little. With these thoughts in mind, why would a golf course facility want to own its equipment? The benefit truly lies in the use of the machinery and not in its ownership, and therefore the concept of leasing demands consideration.

Leasing Basics

Although most golf course superintendents are unfamiliar with leasing, other major industries are no strangers to the concept. Everything from heavy equipment, including forklifts, cranes, and barges, to such items as small computers is being leased today. More than 70 percent of major U.S. companies use leasing as a financial tool, according to the American Association of Equipment Lessors in Arlington, Virginia. To emphasize the popularity of leasing, one need only look to its remarkable expansion from 1980 to 1992. In 1980, $43 billion of

equipment was leased. By 1992, that figure had risen to a staggering $120 billion. Perhaps these facts will help dispel some of the falsehoods about leasing and help decision-makers in the golf industry to become more comfortable with its application.

There are many variables involved when considering a lease for golf course equipment needs. Without question, leasing is a bona fide financial alternative, but because of its complexities, the entire process must be examined closely before making any commitments. Though leases vary from company to company, there are some general statements and recommendations that will pertain to all leases.

How Does Leasing Work?

Leasing is an extremely simple process. The leadership of the course (lessee) specifies the equipment desired, including both the manufacturer's name and model number along with any special options desired. The machinery could range from a small "flymo" for bunker bank maintenance to a large rotary unit and new tractor for mowing roughs. After negotiating with the vendor for the best price, a leasing company (lessor) should be selected.

Several leasing companies should be interviewed to ensure that the rates and terms of the lease are competitive. After the selection process is complete, serious negotiations can begin, including the type of lease, length, and payment schedule. After these issues have been resolved, a lease is signed and the leasing company purchases the equipment specified in the contract. When the machinery is delivered, it is checked out and, assuming everything is as specified, the lessor pays for the equipment. The lease is then considered to be in effect.

The most common type of lease a golf course facility will enter into is a net lease. Under these guidelines, insurance, taxes, and maintenance all are paid for by the lessee. Following a specified amount of time (usually three to five years), the lease ends. At that time the leadership may decide among three different courses of action. They may return the equipment to the lessor, pay the fair market value for the equipment, or upgrade to brand-new machinery.

As mentioned earlier, all lease companies and their rates are not the same. Another way to get started is to send a standard bid request form to various leasing firms. In this manner, decision-makers can be assured that they are comparing "apples to apples" in the lessor selection phase of the project. A sample bid form and a list of possible leasing companies can be obtained by calling the Equipment Leasing Association of America in Arlington, Virginia, at (703) 527-8655.

Benefits of Leasing

1. Tax Benefits

The leasing of equipment by golf courses benefits both the lessor and the lessee. The lessor is able to claim the tax benefits of owning the machinery and can pass some of these savings to the golf course by lowering the scheduled payments. The leasing company also claims equipment depreciation, and the course can deduct the lease payment as an operating expense. Thus, one of the principal benefits to golf courses financing their equipment acquisition by this method is the realization of tax benefits that would otherwise be lost. To determine whether or not your golf course can qualify for this benefit, a qualified tax accountant must be consulted.

2. Preservation of Working Capital

This is a primary reason golf courses should give leasing strong consideration. Utilizing the lease format, a golf course can finance virtually 100 percent of the cost of the equipment. Compare this to a conventional bank loan that demands a down payment of 10 to 20 percent. Obviously, the amount of the down payment depends on the credit worthiness of the buyer, the equipment being purchased, and current economic conditions. In any event, for a $250,000 loan, a club would need to raise $25,000 to $50,000. Many courses would not have this amount of cash readily available or even be able to secure a loan for the down payment.

In some cases, it is wise to combine both traditional financing and the leasing alternative. For example, if the maintenance shop is in need of renovation, the course might borrow the money from a bank for the restoration work, but choose leasing for acquiring the equipment they need badly. In other words, leasing can help preserve a course's borrowing power for times when it is really needed.

3. Restricted Use Needs

When a specialized piece of machinery is required only for a short period of time, leasing can be used effectively. This solves the dilemma of selling the equipment when

Leasing may allow you to take advantage of recent improvements in aerification and core processing.

the work is completed and often can be more cost effective than renting. For example, a golf course in the process of renovating bunkers or attempting to correct major drainage problems would be wise to invest in a backhoe. However, once the job is completed, the equipment may no longer be of use to the course. At that time it would be wise to sell the machine to another user. If it is unlikely that the backhoe will sell quickly and with relative ease, then leasing clearly would be superior to purchasing.

Perhaps most important, leasing commits the golf course to a sound equipment investment program. Once initiated, the club is committed to monthly payments for the duration of the lease, regardless of frequent changes in golf committees and the boards of directors. That is truly what leasing equipment for golf courses is all about — promoting timely equipment acquisition and replacement.

4. Custom Lease Payments

The payment schedule with many leases can be tailored to meet the needs of the facility. If the busy times of the year are March through October, payments can be arranged over those eight months. Negotiations also can structure higher payments early in the lease and lower payments later on (or vice versa, depending on the needs of the course).

5. Financing Considerations

Usually, leases for smaller pieces of equipment can be arranged more quickly than through other financing sources. Documentation also is less cumbersome for closing the deal.

Finally, many lessors will write master leases. These function in a fashion similar to a line of credit at a bank. A predetermined dollar figure is set, as is the time period (usually for one year or less). This allows the course to select different pieces of equipment from different vendors throughout a given year. The lease is structured such that the financing costs and other lease conditions are known well in advance of the acquisition. After the original master lease has been designed, the documentation for new equipment becomes very simple.

Disadvantages of Leasing

We have touched on several positive aspects of leasing. Predictably, there is a downside as well. If a club has been keeping up with equipment replacement on a timely basis through the years and can afford to pay cash for new equipment, this is the least expensive option. However, even the club that has the ability to purchase equipment outright may find that leasing would free up those funds for other investments.

Perhaps the disadvantage mentioned most often concerning this method of financing is that the lessee gives up the chance to realize any monetary gain if the equipment used appreciates in value. Obviously, this is a rare occurrence in terms of course maintenance, as the wear and tear on machinery depreciates its value very rapidly. However, it definitely has application in the golf course construction industry, where large pieces of equipment such as bulldozers and scrapers can appreciate in value over time.

Finally, a leased piece of equipment should not be substantially modified. When a tractor or mower is leased, in essence it is only borrowed and should not be changed without permission from the lessor.

Where to Lease

In addition to contacting the Equipment Leasing Association of America, a search can be made for lessors located closer to home. These include individuals, banks, lease brokers, independent leasing companies, and captive lessors. Independents and captive lessors provide the majority of funding for golf courses.

Independent Leasing Companies

These companies are the major source of lease financing for all types of equipment in the country. They operate in a fashion similar to banks that lend money for equipment purchases. Instead of maintaining an equipment inventory, they purchase the machinery specified by the golf course.

Master leases make it possible to obtain a tractor from one vendor and rotary mower attachments from another.

When the equipment is delivered, the leasing company pays for it, receives the title, and the lease is put into effect.

Captive Leasing Companies

A rapidly growing segment of the leasing industry is captive leasing companies. These types of lessors are directly associated with individual equipment manufacturers. Captive lessors' primary purpose is to offer "captivating" lease packages to help make their machinery and prices more attractive than the competition's. This allows the manufacturer and distributors to move more machinery and increase their profits, resulting in the company being able to pass along a lower finance rate to the golf course.

Case Studies

1. Leasing Equipment

A municipal golf course in western Nebraska recently decided to commit to leasing for their equipment needs. They leased approximately $225,000 worth of new equipment, and because the order was so large, the distributor agreed to $20,000 worth of the most commonly used parts at his cost.

The course had been spending approximately $38,000 on equipment repair each year. This figure by itself is a good indicator that their equipment was long overdue for replacement. During the first year of the lease, there was very little repair expense for the club simply due to the newness of the equipment and the fact that it was still under warranty. As stated earlier, the club also purchased $20,000 worth of parts. This will help them get through at least another year with very little routine maintenance expense. Finally, while years three through five will see an increase in the repair expenses, that figure probably will be less than half of the $38,000 that had been spent in previous years.

The superintendent noticed an increase in the efficiency and morale of his entire staff. Less down time for repairs to the old equipment meant more time spent conditioning the course. And just like buying a new car, the workers were proud of their equipment and looked forward to coming to work each day. This culminated in an increase in the crew's productivity and an improvement in their quality of work, and they took much better care of the machinery.

2. A Twist on Assessments

A country club in central Oklahoma financed the purchase of new equipment using another alternative. They assessed each member $300 to raise approximately $180,000. Though there is nothing new about assessing the membership, the club has promised to pay back the money whenever a member leaves for whatever reason. Not only has the new equipment made a difference on the course and to the staff, each member is proud to play a small part in improving the playing conditions on the course.

For a course to look this good, modern equipment is a must.

Not to be overlooked is the fact that both golf courses received a sizable discount for buying in volume. Not only did they end up getting the best deal on the equipment, but they received excellent service after the sale as well. Vendors realize the importance of keeping these clients satisfied.

Conclusion

There are many alternatives to consider when acquiring new equipment. Leasing is becoming more popular for country clubs and municipalities because of its inherent benefits. To more fully understand the complexities and advantages of leasing, two books on the subject are highly recommended:

The Handbook of Equipment Leasing
Richard M. Contino
Amacon Publishing
New York, New York

Equipment Leasing
Pete K. Newitt and Frank J. Fabozzi
Dow Jones - Irwin Publishing
Homewood, Illinois

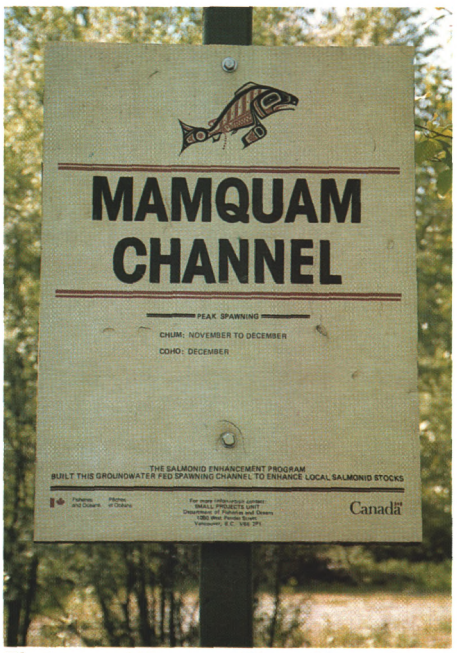
Without question, part of the long-term financial health of a golf facility involves timely equipment replacement programs. If these programs are neglected, the conditioning of the course suffers and the maintenance of the older equipment becomes inefficient and expensive. Conversely, if the equipment inventory is kept current, the course, the turf, and the golfers will all benefit.

SQUAMISH VALLEY — The Home to Birdies and Eagles

by DAVID BANBURY,
Superintendent, Squamish Valley Golf and Country Club, British Columbia, Canada

YOU'VE SEEN the headlines: "Pesticides Kill Canada Geese" . . . "Large Duck Kill from Pesticide Overdose" . . . "Fish Kills Linked to Pesticide Spill." How about "How Green Are These Fairways?" While it is agreed these headlines raise some valid concerns, it sure doesn't describe the conditions found in our little piece of heaven, Squamish Valley. Just the opposite has happened as our golf course has become home to a remarkable story of wildlife enhancement for an entire community.

The Squamish Valley Golf and Country Club is a public golf course found at the end of Howe Sound, on the way to the spectacular resort community of Whistler, B.C. It is an area of natural beauty, including fresh mountain streams, large wooded areas, mountainous terrain, and some of the largest granite outcroppings in North America. At one time it was home to a large number of salmon, eagles, bear, and other wildlife, yet over time, these populations dwindled. It is at this point where the story of wildlife resurgence in Squamish Valley begins.



The improved Mamquam Channel is now home to millions of salmon fry.

A Natural Catastrophe

We are blessed in our area to have a natural phenomenon that keeps everything green — rain. Is usually falls over extended periods, yet seldom causes severe flooding or flash floods. This was not the case during the winter of 1979-1980 when the normally calm Mamquam River decided to overflow its banks. The dike protecting our golf course was overrun on the night of January 1, 1980. With it went the tenth hole and all the four- to six-foot-circumference spruce trees. If not for the hardiness of the turf, a channel could have cut through the golf course, making holes 8, 9, 11, and 12 a virtual island. Thank goodness for our turf cover!

The next morning we could see that our New Year's resolution would be to get back our golf course and improve the dikes. After two days, the water retreated and local logging road builder Sam Goss was brought in to shore up over a mile of diking.

A Cooperative Effort

When two herbicides are combined and produce results better than when used separately, it is called synergism. When three separate human groups must work together to achieve a common goal, it often is termed chaos! Fortunately, we did not have this situation as we addressed the needs of the golf course, the construction company, and the fisheries agency.

With over a mile of diking required and a need to raise the dike by an additional 12 feet, we could see the potential for real problems. Where would all the fill come from? Sam and his crew worked for the next six weeks with available material, but the cost of additional fill was prohibitive. At this point, we discussed an idea that would forever change the relationship of our golf course with local wildlife.

The golf course had a small irrigation pond that was too small for summer use. It was located next to the river and overflowed continually, thus creating a small creek. The salmon liked the shallow creek and pond, so they decided to call it home. The only problem was that the small salmon fry were always plugging the intake and irrigation system. Since material was needed for diking and we needed a larger irrigation pond, our problems apparently were solved. The only snag left was to take care of the spawning fish.

The Fisheries Department was fond of the spawning pond, yet understood the dilemma. We suggested constructing a spawning channel that would receive a constant flow of water from the river, yet would be protected by the dike. This would create a protected spawning area that, in time, could return large populations of salmon to the river. With some reservations, the Fisheries Department agreed to the idea. We completed the dike and created a spawning channel 65 yards from the golf course.

A Resounding Success

During the fall of 1980, the salmon came back to spawn and moved into our newly constructed Mamquam channel. Due to the shallow water and lack of cover, the chum, sockeye, and coho salmon were easy prey for approximately 20 bald eagles, yet they completed their spawning cycle and the fry returned to the ocean to grow. During the next few years there was little change in the fish populations. Beginning in 1984, the first chum, coho, and sockeye started to reappear with dramatic increases. With beginning numbers of 50 coho in 1984, over 6,000 were counted in 1987. Today's numbers are in excess of 400,000 fry. Chum salmon have grown from several thousand in the mid-1980s to over 4 million fry today!

While the fish stock had a significant increase, our channel had an impact on several other animal populations as well. Increased numbers of coyote, bear, and kingfishers were noted. Various ducks and geese have flourished, though nothing compared to the increase in the bald eagle populations. From a starting point of 20 eagles in 1980, we currently have in excess of 200 that visit in the fall for feeding time. It is quite a sight as these magnificent birds sit in the cottonwoods above the golf course!

A Clean Stream

The story of Squamish Valley is quite different from those in the media denouncing golf courses as bad for the environment. During the entire process, Bob Brown from the federal Fisheries Department helped to

(Top) David Banbury, superintendent at Squamish Valley Golf and CC, works closely with various fisheries agencies to assure success with the spawning pond. (Above) Natural seepage from the river provides a constant flow of water for the spawning salmon.

keep us informed about the ever-increasing numbers of fish in our channels. At the same time, water purity samples have been sent to our provincial laboratories. Little, if any, fertilizers or chemicals have been detected that could have come from the golf course. The survival of the fish eggs in the "eye" stage was 94.5 percent in 1987! This is considered a very high level of survival, thus providing further evidence that our golf course has no negative impact on the fish populations.

So what is the point of the story of Squamish Valley? It is simple. Man can live in harmony with nature. We can actually improve upon nature if given a chance. Golf courses are not toxic waste sites and, if managed properly, can provide an excellent site for the enhancement of wildlife species. We have accomplished this by working with various agencies, not by establishing opposite views and being confrontational. It may work at your golf course if you face a similar situation. Above all, our little golf course has proven to be a big asset to our community, and we take pride in Squamish Valley — the home to birdies and eagles!

One clear sign of an irrigation system with undersized main lines and laterals is the loss of operating pressure at sprinkler heads located furthermost from the pump station.

RAIN MAKING

by PAUL VERMEULEN
Agronomist, Western Region, USGA Green Section

IN JOHN STEINBECK'S *The Grapes of Wrath*, an entire generation of Americans was forced out of the mid-continent region by severe drought. While Steinbeck's novel itself is fictional, such catastrophic events have actually happened and have had a major impact on people's lives. Thankfully, however, mankind's increasing technology and subsequent ability to deal with Mother Nature are making a difference in the way people now live.

One shining example of how technology has made a significant difference is the mere presence of millions of residents in the arid region of Southern California. As impossible as it sounds, this astonishing miracle is the result of transporting water through aqueducts across mile after mile of uninhabited desert.

On a smaller scale, golf course irrigation systems also can produce miraculous results if, and only if, they are specifically designed to do so. Although some people suggest that an irrigation system should be designed only to supplement Mother Nature, not replace Her, good irrigation systems are designed to meet the true peak demand of the course. Perhaps this point should be self-evident, as indeed the only time an irrigation system should be turned on is when Mother Nature has failed to provide adequate rainfall.

To help make rain at your course, key features of a well-designed irrigation system need to be identified. The following information is intended to help familiarize both those who are planning to install a new irrigation system in the future and those who are searching for criteria to evaluate whether their existing irrigation system is state of the art or simply out of date.

Whether installing a new irrigation system or evaluating an existing one, the most important point to keep in mind is performance. Simply stated, good irrigation systems are those that are capable of economically applying water precisely when and where it is needed to sustain good-quality turf under drought conditions. The exact opposite is true for bad irrigation systems — they apply too much water in one location and not enough in another, and do so at great expense and inconvenience.

Pumps and Pipes

For discussion, the key features of a good irrigation system can be grouped into three categories. The first category, pumping and

piping, is the heart and arteries of an irrigation system.

As the old adage tends to suggest, when it comes to pumping stations, the bigger the heart, the better. But exactly how big is big enough for new systems, and how small is too small for existing ones?

As previously mentioned, good irrigation systems are those that are capable of meeting the peak demand of the course. Peak demand, in theory as well as in practice, is the amount of water needed during a 24-hour period to sustain healthy growth during prolonged drought conditions. Given the dramatic regional differences in climate, soil classification, and turfgrass species, an accurate figure for peak demand should be obtained from a nearby university or other regional authority.

The other bit of information needed to determine proper pump station size is the time interval within which the course must be irrigated. In the past, the standard time interval, or *watering window,* as it is sometimes referred to, was simply the shortest seasonal interval between the last foursome walking off the 18th green and the first foursome teeing off on the first tee the next morning.

Today, however, many power companies are offering reduced pricing schedules that make it financially attractive to complete nightly watering of a course in as little as six hours. Also, in cases where reclaimed water is being used, special regulations may state even greater limitations.

Now back to answering the question about how big is big enough for new systems, and how small is too small for existing ones. As an example, take a course in the western United States with a peak demand of 1,000,000 gallons per day during drought conditions and a financially attractive six-hour watering window. Since there are 360 minutes in a six-hour period, the pump station must have an output of approximately 2,800 gallons per minute to meet the 1,000,000-gallon peak demand.

Having determined the proper size of the pump station, the next key feature of a good irrigation system is its mainlines and laterals. For those installing a new irrigation system, pipe sizing must be left to the design engineer.

Don't be bashful, though. Insist that the mainline system be adequately looped (i.e., interconnected), where necessary, both to minimize pressure losses and allow segments of the course to be shut off with isolation valves in case of emergency. Remember, the opportunity to upgrade at a later date will never present itself without unearthing the entire system. Such an unfortunate necessity would be far more expensive than installing it right the first time.

For those evaluating an existing irrigation system, the signs of undersized mainlines and/or laterals include frequent pipe breakage and excessive loss of operating pressure for sprinkler heads located furthest from the pump station. It should be noted that pipe breakage can also be the result of installation of underrated pipe.

The Control System

The second category, the control system, brings the discussion to a fundamental principle of golf course maintenance — that

In order to use reclaimed water for irrigation, many courses will need to install new irrigation systems capable of completing nightly watering in as little as six hours to avoid public contact.

greens, tees, fairways, and roughs all have their own unique watering requirements. For example, consider a creeping bentgrass putting green constructed with a sand-modified root zone positioned next to a hybrid bermudagrass fairway established on a clay soil. To accommodate the individual watering requirements of each area, the irrigation system must be designed with opposite-facing 180-degree sprinkler heads.

Good irrigation systems also compensate for variables such as slope, soil texture, shade, and other factors by operating small groups of sprinkler heads from the central controller. Under most circumstances, no more than two or three sprinkler heads should be grouped together. Under extreme circumstances, however, irrigation systems are now being designed with individual head control not only on greens, but also on tees, fairways, and roughs as well.

Good control of an irrigation system should not sound extravagant. Have you ever heard someone complain about having too much control of an irrigation system? Too little, maybe, but never too much.

In addition to the installation of 180-degree sprinkler heads around greens and small groupings within an irrigation zone, good irrigation systems have quick-coupling valves at every green and tee, and at 200- to 300-foot intervals along the fairways. These manual valves allow small areas of turf and newly planted trees to be conveniently watered when necessary.

For those evaluating an existing irrigation system, the extent of control over water application between and within irrigation zones boils down to an issue of quality. Ask yourself the following questions. Is it acceptable to have under-watered rough areas around greens because one group of sprinkler heads covers both areas of the course? Can small areas or trouble spots be watered without having to haul water in a spray tank? Are areas of the fairways too wet because four or five sprinkler heads are wired together on each satellite controller station? Depending on the answers to these and other similar questions, it may be time to abandon the existing irrigation system.

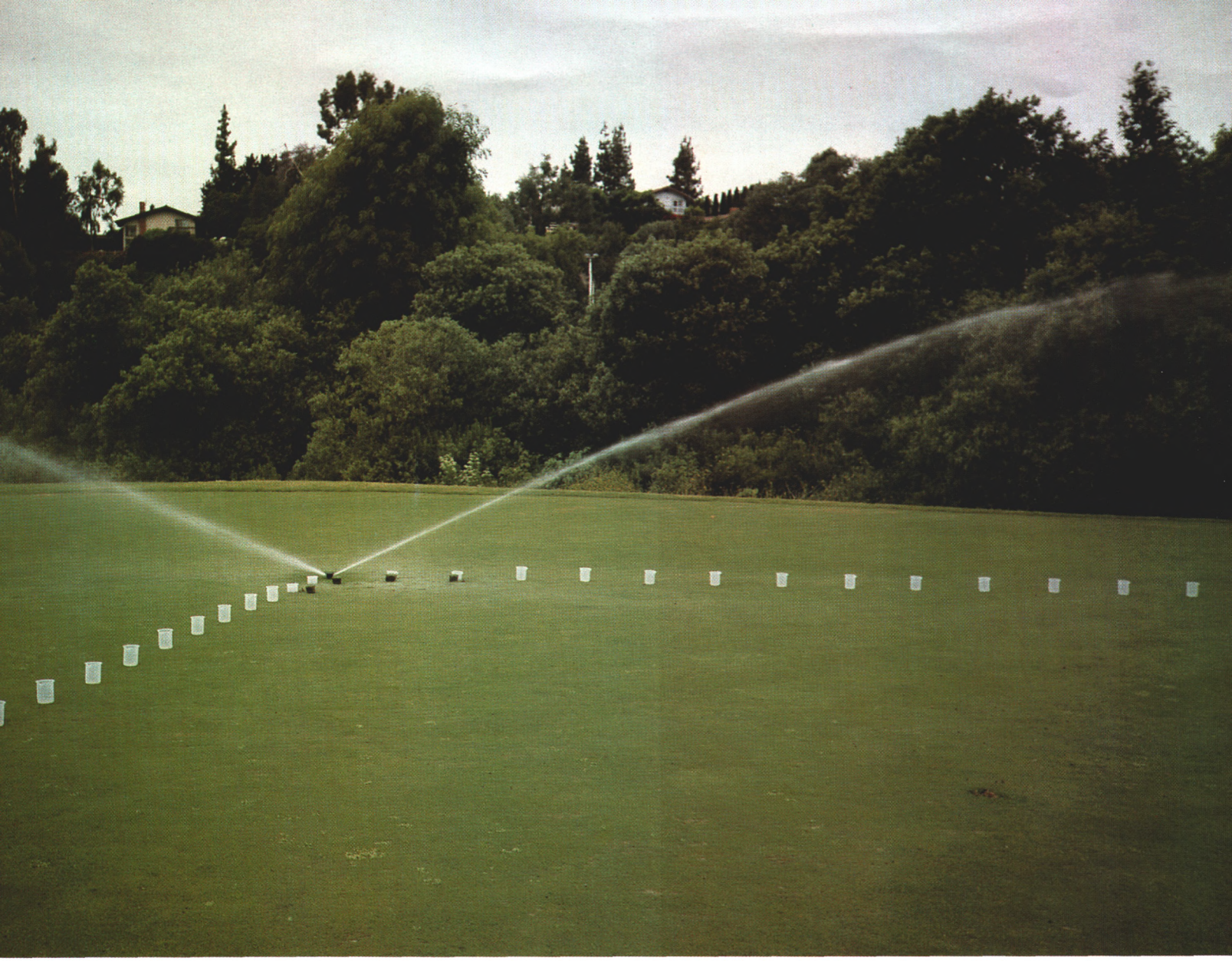
A few words about the brains of the control system, or more specifically, the central controller. Today, most, if not all, good irrigation systems use a computer and on-site weather station to help schedule nightly irrigation cycles. The advantage of having a computer is that it can be used to program the shortest possible irrigation cycle that places a consistent demand on the pumping station and minimizes pressure surges in the main lines.

Existing irrigation systems that may need replacement have electro-mechanical control systems that start and stop groups of sprinkler heads in an unpredictable or erratic fashion. In many instances, both the demand on the pump station and operating pressure continuously fluctuate. As a result, nightly irrigation cycles take longer than necessary, increasing electrical costs and placing undue wear on the entire system.

Sprinkler Heads

The last category, sprinkler heads, is one that has received little attention in most articles discussing irrigation system performance. Sprinkler heads have one simple function, and that is to distribute water evenly over the surface of the course when properly spaced. Perfection should not be taken for granted, however, because of two basic reasons.

First, some sprinkler heads are poorly engineered. Believe it or not, all sprinkler



When installing a new irrigation system, selection of a particular sprinkler head model should be based solely on performance. Evaluation requires measuring the amount of water distributed at regular intervals away from the sprinkler head and then analyzing the data with special computer software.

heads have what some might call an individual fingerprint. This unique print can easily be determined using data (the amount of water) collected from rain gauges placed at 12-inch intervals along a line extending outward from the sprinkler head itself.

Using the data, a denso-gram can be generated with a computer program called S.P.A.C.E. (Sprinkler Profile And Coverage Evaluation). This graphic reveals the exact water distribution pattern for each sprinkler head model when operated at any given spacing with identical complimentary sprinkler heads.

The computer program also generates an irrigation scheduling coefficient to help interpret the significance of the denso-gram. This value indicates the amount of extra watering time required during nightly irrigation cycles to provide enough moisture to the critical dry area of the denso-gram pattern. Final selection of a particular sprinkler head model should be based on the lowest scheduling coefficient at the manufacturer's recommended spacing.

Knowing that all sprinkler heads are mechanically different and that they have unique requirements in terms of spacing, operating pressure, etc., it stands to reason that the first decision when installing a new irrigation system should be on what model of sprinkler head to install. This establishes the primary criterion to enable the design engineer to draw up plans that will produce optimum long-term performance in terms of even water distribution. Computer evaluation also can be used on existing irrigation systems to evaluate the amount of water and electricity wasted by poor water distribution from the sprinkler heads. By collecting data from the field and imputing the sprinkler head spacing and orientation, the scheduling coefficient of an existing irrigation system can be determined.

Second, some well-engineered sprinkler heads can perform poorly in the field because they are not spaced properly. Based on years of trial and error, the most practical sprinkler head spacing has proven to be 60 to 65 feet in a uniform equilateral triangular or square pattern. This fact has also been reaffirmed by computer analysis with S.P.A.C.E.

In conclusion, becoming familiar with the key components of a good irrigation system can help you *make rain* the next time Mother Nature turns her back on your course.

ASSESSING CHEMICAL HAZARDS ON GOLF COURSES

by C. J. BORGERT,[1] S. M. ROBERTS,[1] R. D. HARBISON,[1] J. L. CISAR,[2] G. H. SNYDER[3]
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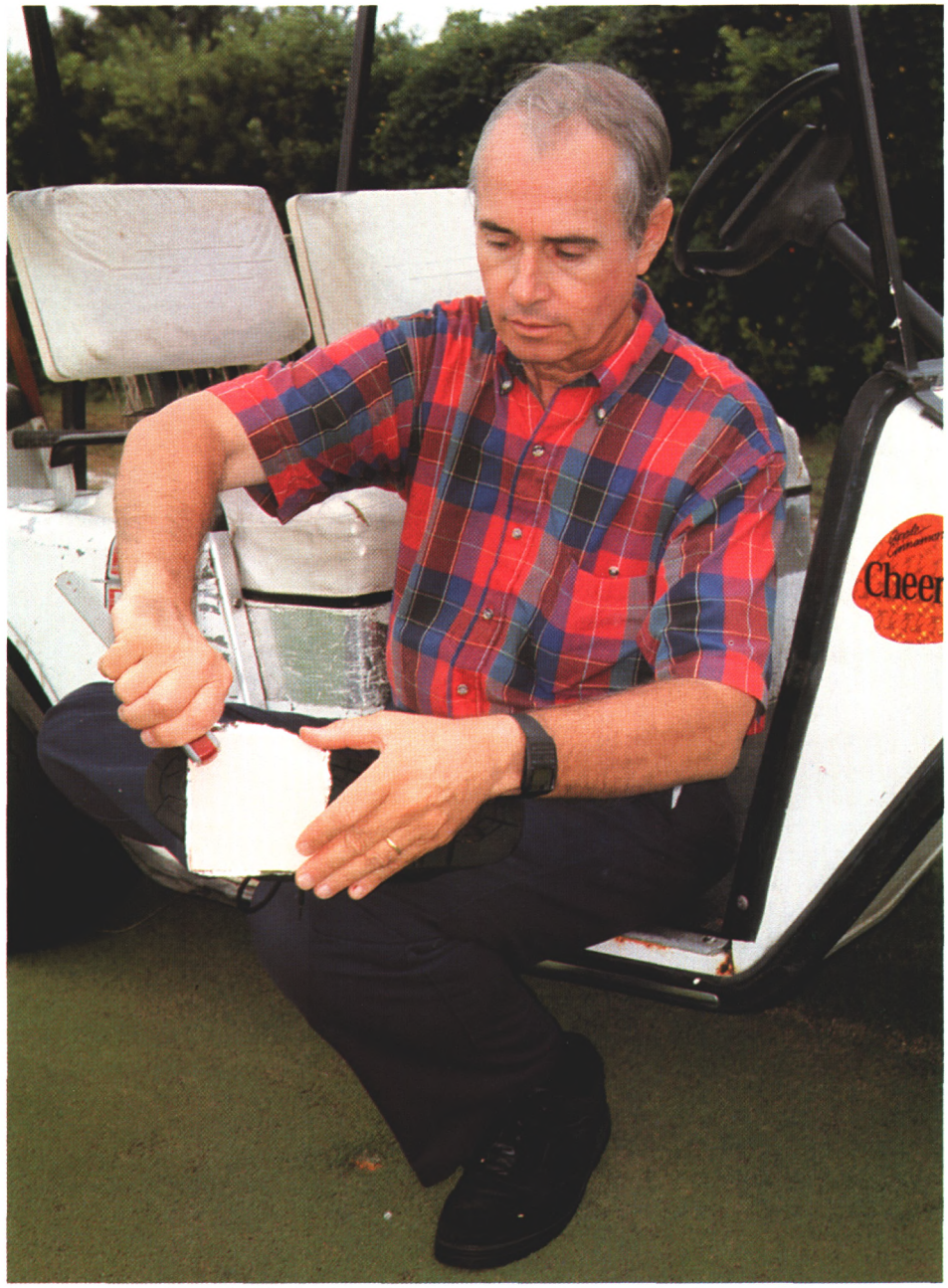
[3]Everglades Research & Education Center, Belle Glade, FL

FEAR of chemicals in the environment ranks high on the list of anxieties for many Americans. Because this concern extends to nearly every industry and activity in our society today, it should come as no surprise that fears have arisen in regard to chemicals used on golf courses, such as pesticides.

Before we can decide how concerned we should be about chemicals in our environment, and on golf courses in particular, there are some basic, common-sense rules that should be kept in mind. First, any chemical can produce toxicity in living organisms. Second, for a toxic effect to be produced, an organism must actually be exposed to the chemical and the exposure must result in a dose sufficient to produce toxicity. In other words, the *dose* makes the poison. Third, chemicals have specific and consistent effects.

These simple facts are often misunderstood in our society. Many assume, incorrectly, that the mere presence of a chemical constitutes a health threat. Yet we all know this is not true. If the mere presence of a chemical in our environment could produce health effects, then aspirin could relieve headaches without being swallowed. If the dose did not determine the poison, one glass of wine would be as inebriating as an entire bottle, and it would make no difference if the wine was swallowed or poured on one's feet! If chemicals did not have specific and predictable effects, their use as medicines would be impossible. Too often we fail to apply the common sense of dose and response to chemicals with which we are unfamiliar.

Risk assessment is the application of these and other principles of toxicology to help us rationally decide our level of concern about chemicals encountered in the environment. Risk assessments are methods for comparing levels of chemicals in the environment with doses that produced no ad-



Leather patches, backed with aluminum foil, were stapled to a shoe sole prior to walking on a pesticide-treated turf surface.

verse effects in laboratory animal studies or environmental toxicity tests. These methodologies can be applied to turfgrass systems to help ensure that chemicals are used in amounts and frequencies that do not pose unacceptable health or environmental hazards.

An example of the methodology used to assess the concern about chemicals used on golf courses is illustrated here by considering three pesticides applied to a putting green. Our approach is consistent in principle with the Baseline Human Health Risk Assessment used by the U.S. Environmental Protection Agency (U.S.E.P.A.) to evaluate hazardous waste sites and chemical contamination of soil, but is modified and refined specifically for a putting green. Our assessment is preliminary in nature and should in no way be considered thorough or complete. It is intended only to illustrate some principles of health risk assessment as applied to golf courses and is not a definitive evaluation. Our goal was to suggest how risk assessment methods can be used to address concerns regarding chemicals used on golf courses. We utilized preliminary data to conduct a limited health risk assessment for a putting green and illustrated how such information can assist decision-making regarding levels of chemicals that may warrant concern.

The first step in health risk assessment is to evaluate the ways a person might come into contact with chemicals at a particular site, in this instance a putting green, and to take measurements of chemicals at those points of potential exposure. We evaluated the potential exposure to three pesticides on a putting green for a golfer who plays 18 holes of golf. We considered four pathways of exposure for this golfer. We assumed that this theoretical golfer would 1) kneel on the green to align putts, 2) handle golf club grips that have been laid on the green, and 3) contact the soles of golf shoes while cleaning them after the round. These are dermal exposure pathways, i.e., those that involve absorption of chemicals through the skin.

Because skin is an effective protective barrier against entry of most chemicals into the body, very little chemical that contacts the skin is actually absorbed in most instances. The dermal permeability factor for a chemical reflects the fraction of chemical applied to skin that might actually be absorbed. Although oral exposure pathways would probably be less significant for most golfers than dermal pathways, as an extreme case we assumed that the golfer would 4) clean his golf ball by licking it. This is an ingestion exposure pathway. We assumed that all of the pesticide ingested is actually absorbed into the body because the intestinal tract generally is not an effective barrier to the absorption of organic chemicals.

For the sake of presenting a reasonable maximum exposure, we took measurements 24 hours following application of diazinon, chlorpyrifos (Dursban 2E), and isazofos (Triumph 4E) at rates of 470, 57, and 229 mg active ingredient per square meter of turf. The measurements were taken from a preliminary study conducted on a Tifgreen bermudagrass surface at the Ft. Lauderdale Research and Education Center, University of Florida, and the pesticide analysis was conducted at the Everglades Research and Education Center, Belle Glade, University of Florida. This research on pesticide dislodgeability was sponsored by the Florida Turfgrass Association and by the USGA Green Section.

We measured the amounts of pesticides retained on a) a 10 cm square piece of cotton attached to one knee while kneeling for 10 seconds to simulate aligning a putt, b) a 10 cm square piece of leather attached to a shoe sole following 10 steps on the treated turf surface, and c) a golf ball putted 36 times over a distance of 4 meters per putt. From the amount of pesticide retained on leather shoe bottoms, we estimated the amount that might be retained on leather golf club grips laid on the putting green. These data are presented in Table 1.

Using the levels of pesticides listed in Table 1 for each exposure point, we calculated the dose of each pesticide that a golfer might receive from each of the exposure pathways and summed the doses from all pathways to arrive at the golfer's total dose. The equations used to calculate dermal and oral doses are listed in Table 2. The golfer's

Table 1
Exposure Point Quantities of Pesticides

Quantity of Pesticide on Pant Knee (QP_k)	
Diazinon	0.00994 mg
Isazofos	0.00198 mg
Chlorpyrifos*	0.000025 mg*
Quantity of Pesticide on Shoe Sole (QP_s)	
Diazinon	0.000650 mg
Isazofos	0.000368 mg
Chlorpyrifos	0.000330 mg
Quantity of Pesticide on Grip (QP_g)	
Diazinon	0.0000975 mg
Isazofos	0.0000552 mg
Chlorpyrifos	0.0000495 mg
Quantity of Pesticide on Golf Ball (QP_b)	
Diazinon	0.000775 mg
Isazofos	0.000241 mg
Chlorpyrifos	0.000240 mg

*Chlorpyrifos was not detected on cloth. However, because chlorpyrifos was known to be present on the turf, we used a value of one-half the detection limit of the assay for chlorpyrifos on cloth, which was 0.000025 mg. This approach is consistent with USEPA guidance for "non-detects."

Legend for Table 1

(QP_k): Quantity of pesticide adsorbed to 10 cm square of cotton cloth after kneeling. We assumed two kneeling contacts with turf per hole.

(QP_s): Quantity of pesticide retained on leather soles of size 10 shoes after 10 steps on turf surface. This exposure assumed that the golfer's hands contacted the entire sole of each shoe during cleaning after each round.

(QP_g): Quantity of pesticide retained on two leather club grips was estimated by assuming retention rates equal to the leather shoe sole, and that 15 square centimeters of each club grip contacts the turf.

(QP_b): Quantity of pesticide retained on ball following 36 putts of 4 meters each. We assumed that the golfer licked and swallowed all of the pesticide on the surface of the ball.

total doses were then compared with doses considered by the USEPA to be safe for a person to receive every day for a lifetime (a dosage called the "Chronic Reference Dose," or RfD). Chronic Reference Doses take into account that toxicity can accumulate for some chemicals in some organ systems when the chemical is received as frequently as every day. Although we calculated single doses from one round of golf, we compared these doses with chronic RfDs, which are safe doses that can be received daily for a lifetime. The comparison was made by calculating a "Hazard Quotient," which is the person's total dose divided by the RfD (see Table 3). Doses below the RfD yield Hazard Quotients less than 1, and those greater than the RfD yield Hazard Quotients greater than 1. If the calculated dose is equal to the "safe" dose (RfD), then the Hazard Quotient equals 1.

In order to consider the entire putting green as a unit, we summed the Hazard Quotients for all three pesticides to arrive at a "Hazard Index" for the putting green (see Table 3). This takes into account any potential for additive toxicity from two or more chemicals. A Hazard Index less than 1 would indicate that the person's dose of each pesticide is below its respective "safe dose" or RfD, and that the additive potential does not exceed a "total safe dose." The USEPA considers a Hazard Index less than 1 to indicate that there is no increased health risk. In other words, a Hazard Index less than 1 indicates that all contaminants are present at concentrations below those that could cause effects in humans, even if the chemicals have additive effects.

Table 2
Dermal and oral doses of three pesticides expected from exposure to putting greens during a round of golf

Pesticide	Dermal Dose[1]	Oral Dose[2]	Total Dose
Diazinon	0.0000172 mg/kg	0.0000125 mg/kg	0.0000298 mg/kg
Isazofos	0.0000010 mg/kg	0.0000039 mg/kg	0.0000049 mg/kg
Chlorpyrifos	0.0000002 mg/kg	0.0000039 mg/kg	0.0000041 mg/kg

mg/kg = milligrams pesticide per kilogram body weight

$$^{1}\text{Dermal Dose} = \frac{(QP_k + QP_s + QP_g) \times DP}{BW\ (kg)} \qquad ^{2}\text{Oral Dose} = \frac{QP_b\ (mg) \times ABS}{BW\ (kg)}$$

where:

BW = Body Weight: 62 kg (age-adjusted male body weight)

ABS = Oral Absorption Constant: 100% (assumption for organic chemicals)

DP = Dermal Permeability: DP Diazinon = 0.10
DP Isazofos = 0.025
DP Chlorpyrifos = 0.025

Table 3
Calculation of Hazard Quotients and "Hazard Index" — a comparison of the estimated dose with the Reference Dose (RfD), a dose considered safe for lifetime exposure by USEPA

Pesticide	Total Dose (oral + dermal)	USEPA[a] and OPP[b] RfDs	Hazard Quotients[1]
Diazinon	0.0000298 mg/kg	0.0009 mg/kg/d	0.0331
Isazofos	0.0000049 mg/kg	0.00002 mg/kg/d	0.2450
Chlorpyrifos	0.0000041 mg/kg	0.003 mg/kg/d	0.00137

Hazard Index[2] = 0.2795

[a] United States Environmental Protection Agency
[b] Office of Pesticide Programs
mg/kg = milligrams chemical per kilogram body weight
mg/kg/d = milligrams chemical per kilogram body weight per day

$$^{1}\text{Hazard Quotient for Pesticide} = \frac{\text{Total Dose of Pesticide}}{\text{Reference Dose of Pesticide}}$$

[2] Hazard Index for Putting Green = Sum of Hazard Quotients for Pesticides

Preliminary Conclusion

Under the assumptions of this risk assessment, the exposures evaluated could be tripled without exceeding levels considered safe for daily lifetime exposure. Because we compared the doses our theoretical golfer might receive from one round of golf with chronic RfDs, this golfer could receive these doses every day of his life without concern for cumulative toxicity. We caution that this "conclusion" is made as an example only and cannot be applied generally because conditions and pesticide use can vary widely from site to site.

Interpretation of Results and Uncertainty Analysis

The focused risk assessment presented here would indicate that under these theoretical conditions and assumptions, a golfer's exposures to chlorpyrifos, diazinon, and isazofos on putting greens would be considered acceptable because the Hazard Index is much less than 1. But how would we interpret a Hazard Index greater than 1? Although a Hazard Index of 1 or less is considered safe, it is *not* accurate to say that a Hazard Index greater than 1 is therefore unsafe. Because of the large safety factors often employed in developing Reference Doses (10 to 10,000), doses many times greater than the Reference Dose could potentially be all right without adverse effects. A Hazard Index greater than 1 indicates that we are less certain of the potential for adverse health effects from contact with the site, but it does not necessarily indicate that the site is a threat to health. Hazard Quotients and Hazard Indices are interpreted similarly, as summarized in Table 4.

There are numerous sources of uncertainty inherent in the risk assessment process. The extrapolation of toxicity data from laboratory animal studies to human exposure scenarios is an inexact science that introduces much uncertainty into the process. Yet, it is upon these extrapolations that we must often rely to determine doses that are safe from toxicity, such as Reference Doses. Similarly, studies

Table 4
Interpretation of Hazard Quotient and Hazard Index

Dose	Hazard Quotient	Interpretation
Dose < RfD	Dose / RfD < 1	Dose is safe
Dose = RfD	Dose / RfD = 1	Dose is safe
Dose > RfD	Dose / RfD > 1	Safety is less certain

Hazard Index (Sum of Hazard Quotients)	Interpretation
Hazard Index < 1	Site is safe
Hazard Index = 1	Site is safe
Hazard Index > 1	Safety is less certain

Cotton patches, backed with aluminum foil, were pinned over one knee for tests simulating kneeling while aligning a putt.

of chemical absorption are rarely done on human subjects and may be the source of considerable uncertainty in estimating chemical intakes. The dermal permeabilities we used are rough estimates based upon published studies, but a more thorough examination of the literature may yield information that enables us to refine these estimates.

The assumptions we made regarding exposure events and durations are worst-case scenarios and would apply to very few people. Age-adjusted body weights are averages and actually fit only a small number of people. Summing the toxicity scores (Hazard Quotients) of various chemicals may overestimate potential health risks from chemicals that target different tissues and organs. Conversely, the potential for synergistic toxicity is not directly considered in the risk assessment process.

The current means of addressing these uncertainties are through extreme conservatism in all extrapolations and assumptions and by the use of large "uncertainty factors" that reduce the chemical dose considered safe. For example, determination of Reference Doses is typically done by finding the dose at which no effects are produced in rats or mice and dividing that dose by a "safety factor" of 10 to 10,000. These safety factors are used to account for uncertainty and to be sure that even the most sensitive humans would not be adversely affected at the Reference Dose. Use of such large safety factors may often result in RfDs (safe daily doses) that are actually far below a dose that could produce effects in humans. This approach is prudent because the process of health risk assessment is intended to support decision making that is protective of public health and the environment rather than to accurately reflect the toxic potential of chemicals.

Risk assessments are only as applicable and reliable as the data upon which they are based. Without adequate data, our ability to identify true health and environmental hazards is reduced and anxiety over chemicals increases. In the absence of data that is specific and complete, risk assessors must resort to conservative assumptions to ensure that risk assessments overestimate rather than underestimate chemical exposures and toxicities. Costly errors can result when evaluations are made on the basis of inappropriate or poorly documented data. The more accurate the data we use to conduct risk assessments, the more confident we can be that our efforts to protect the public and the environment are appropriate and effective.

The risk assessment we report here, though limited in scope and preliminary in nature, illustrates how the methodology can be applied to turfgrass on golf courses. In order to expand and complete this risk assessment, it is necessary to broaden its scope and to reduce uncertainties inherent in its assumptions. To do this, we must verify and expand the database on pesticide fate, transport, dislodgeability and toxicology, and on human behaviors that result in potential exposure. These data are optimized for risk assessments on golf courses when turfgrass scientists and toxicologists collaboratively design the gathering, testing, and analysis of the data. This risk assessment represents our initial efforts to expand the exposure database and refine the risk assessment methodology for use in golf course management.

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ON COURSE WITH NATURE

Grass Carp: Are They Really the Perfect Solution?

by NANCY P. SADLON
Environmental Specialist, USGA Green Section

WHAT COULD BE BETTER than eliminating weeds in ponds and reducing the use of costly aquatic weed-control chemicals? Are grass carp, more formally known as sterile white amur fish *(Ctenopharyngodon idella),* really the perfect solution for weed control? Grass carp are growing in popularity and more states are legalizing their use, allowing pond owners to capitalize on the biological attributes of fish that love to eat aquatic plants. But from an environmental standpoint, is it really a good idea to stock ponds with this fish and watch the weeds disappear?

The jury is still out on the use of grass carp. Despite more than 20 years of experience since the introduction of the white amur to the United States by the Arkansas Game and Fish Department, and subsequent legalization of the fish in numerous other states (38 states at the present time), strong concerns remain among some biologists, naturalists, and state regulators that the fish pose a threat to natural resources. For some states, the white amur is outlawed and still considered too questionable to handle.

Even in states that allow stocking of the white amur, the agencies responsible for permit approvals advise that grass carp are not appropriate for some situations, and there are impacts that first must be considered.

What Are the Considerations?

Grass Carp Are Voracious Eaters

These herbivorous (feeding on plants) fish have been known to eat three times their weight in a given day and can reach 75 to 100 pounds. Multiply the numbers and that's a lot of vegetation consumption. When the food supply is plentiful, these fish have distinct vegetation preferences. When food supplies are limited and the pond gets crowded, they are known to eat just about anything. These characteristics make it difficult to stock just the right number of grass carp so as not to upset the balance and impact the natural diversity of vegetation and aquatic organisms.

Identifying Appropriate Stocking Rates

How many fish does it take to adequately control nuisance aquatic weeds, yet still maintain appropriate amounts of vegetation? There are no definitive answers to this question. Recommended stocking rates provided by state fish and wildlife departments range from five to 25 fish per acre. Consideration also must be given to post-stocking mortality and removal by fishermen. The fish are not only good eaters, but they are good to eat as well.

Triploid grass carp. Courtesy Northeastern Biologists, Inc.

Time is another important factor in maintaining the proper balance. Often, weed control by grass carp is best in the first two to three years after stocking, when the fish are growing. As carp mature, their appetites slow. The tendency is to add more carp at the same rate as the first stocking, resulting in large numbers of fish that need food. Other factors that pose a problem include natural events, such as cold winters, hot summers, and severe water-level changes.

Getting Too Much Vegetation Control

According to Dr. William Haller, University of Florida, the use of grass carp for weed control is often an "all-or-nothing proposition." These fish either control vegetation completely, resulting in complete vegetation eradication, or else they do not consume enough to make a visible difference.

As young fish, they feed on zooplankton, shifting to pond weeds and duckweed. Other

Some Common Aquatic Vegetation Eaten by Grass Carp in the United States

Algae
Filamentous algae*
Cladophora spp.*
Pithophora spp.*
Muskgrass
Chara spp.
Stoneworts
Nitella spp.

Floating Plants
Duckweed
Lemna spp.
Wolffia spp.
Water hyacinth
Eichhoria crassipes
Water fern
Azolla spp.

Emergent Plants
Alligator weed
Alternanthera philoxeroides
Smartweed
Polygonum spp.
Arrowhead
Sagittaria spp.*
Cattail
Typha spp.*
Spikerush
Eleocharis spp.

Submersed Plants
Coontail
Ceratophyllum spp.
Pondweeds
Potamogeton spp.
Naids
Najas spp.
Watermilfoil
Myriophyllum spp.
Elodeas or waterweed
Elodea spp.
Hydrilla verticillata
Eelgrass or wild celery
Vallisneria americana

*Plants not controlled in colder regions. Fish become less active and do not eat these plants when temperatures drop below 60°F.

Plants Not Eaten by Carp

Algae
Single-celled algae
Asterionell formosa
Others

Floating Plants
Watershield
Brasenia schreberi
White waterlilly
Nymphaea odorato

Emergent Plants
Burreed
Sparganeium evrycarpum
Bulrush
Scirpus americanus

weeds and sedges are eaten when preferred species are absent. Filamentous algae is reluctantly eaten.

If you are interested in planting vegetation at the water's edge for aesthetics and wildlife benefits, a challenge presents itself as grass carp mature and seek food. The proper number of fish must be maintained or you will lose the plants you added. It is best to understock to avoid too much weed control. Once fish are added, they are difficult to remove. Planting less-desirable vegetation will work for a while, but eventually non-preferred vegetation will be consumed.

Assurance of Sterility and Containment

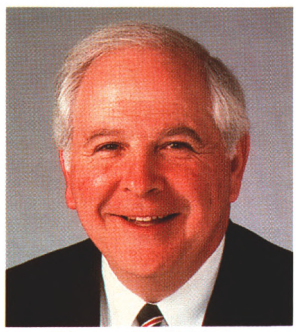
Most states allow the use of grass carp, but they require special permits and guarantees that the fish are triploid (sterile). Many states also require that the fish cannot escape the pond and enter into open water systems, potentially threatening the native flora and fauna, including beneficial game fish species. In Florida, a containment device or jail cage mechanism over the water body outlet is required when using grass carp. New Jersey, which recently legalized the use of grass carp, grants stocking permits only for water bodies that have "reasonable containment" characteristics. If your pond is upstream of or near any endangered or threatened species (plant or animal), permit approval is difficult.

Summary

The sterile grass carp has its place and has been a beneficial method of weed control on golf courses, but these fish should not be thought of as a magic cure-all for weed problems. They require proper management and analysis of site conditions for successful application.

When you choose to stock a pond or lake with grass carp, you are going to affect the ecology of the water body. Too many carp have a deleterious effect on pond vegetation. Too few grass carp have no effect. Other fish species and waterfowl can be impacted if the grass carp are allowed to significantly alter the balance. Numerous state fish and wildlife service policies allow the use of the grass carp for weed control on golf course ponds, but they advise against total eradication of vegetation. Experts say that finding the proper balance with grass carp is the key to successful results.

Spring News Notes



Thomas W. Chisholm

Raymond B. Anderson

Thomas W. Chisholm Named Green Section Chairman

USGA President Reg Murphy recently appointed Thomas W. Chisholm, a member of the USGA's Executive Committee since 1990, to the position of Chairman of the Green Section Committee. He replaces Raymond B. Anderson, who is stepping down from the Executive Committee after a four-year stint as Green Section chairman.

In his new position, Tom will provide direction to the Green Section's many activities, including its Turf Advisory Service, the Turfgrass and Environmental Research program, the Audubon Cooperative Sanctuary Program for Golf Courses, the *Green Section Record* magazine, and other Green Section publications and programs. He also will serve as chairman of the Green Section's Turfgrass and Environmental Research Committee and the Green Section Award Committee.

Tom Chisholm is no stranger to the Green Section, having served on the Green Section Committee for the past four years. During that time he also served on several other USGA committees and was chairman of the Museum and Library Committee and the Public Links Championship Committee. He is a member of the Bloomfield Hills Country Club in Bloomfield Hills, Michigan.

Sincere thanks and best wishes are extended to outgoing Green Section chairman Ray Anderson, whose tenure included a significant expansion of the Green Section's staff and activities. His support was crucial in obtaining Executive Committee approval of a variety of Green Section activities, including the Audubon Cooperative Sanctuary Program and the revision of the Green Section's green construction recommendations. He also oversaw the recently completed three-year, $3.2-million Environmental Research Program, the results of which will be released in 1994. Fortunately, Ray has volunteered to remain on the Green Section Committee and will continue to work for the betterment of golf turf. Thanks, Ray!

Dr. Kimberly S. Erusha

Dr. Kimberly S. Erusha Named Director of Education

The USGA Green Section is pleased to announce the appointment of Dr. Kimberly S. Erusha to the new position of Director of Education. Dr. Erusha, who joined the Green Section in 1990 as Manager of Technical Communications, assumed the responsibilities of her new position as of the first of the year.

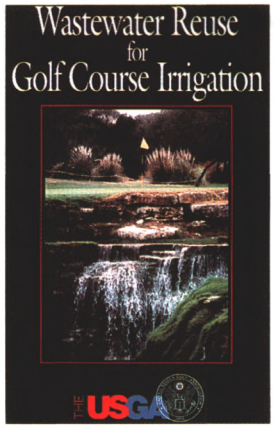
Among Kimberly's new duties will be the coordination and oversight of the Green Section's educational programs pertaining to the results of its turfgrass and environmental research programs and its other environmental activities. The effort will include the development of educational materials directed at golf course superintendents, regulatory officials, legislators, environmental organizations, and the public at large.

Kimberly will continue her current work as assistant editor of the *Green Section*

Record, and she will coordinate the production of other USGA publications, brochures, releases, and other educational materials. She also will have administrative responsibilities related to the Green Section's Turf Advisory Service, a consulting service offered to USGA member courses by the USGA's 16 regional agronomists.

Dr. Erusha received her B.S. degree in horticulture from Iowa State University, and she completed her M.S. and Ph.D. degrees at the University of Nebraska. Her work in graduate school included investigations of how turfgrasses respond to wear and drought stress.

Since joining the USGA, Kimberly increasingly has taken on more responsibilities for Green Section activities, and she has represented the Green Section at numerous meetings and conferences. Her broad knowledge of Green Section programs and research activities makes her well suited to her new position, ensuring an ever-increasing range of services from the Green Section for the benefit of golf.



New Book on Golf Course Irrigation Available

The USGA is pleased to announce the release of a new book titled *Wastewater Reuse for Golf Course Irrigation*. The 304-page book consists of the proceedings of the Golf Course Wastewater Symposium held in March 1993, sponsored by the USGA, American Society of Golf Course Architects, National Golf Foundation, Golf Course Builders Association, and the Golf Course Superintendents Association of America.

Wastewater Reuse for Golf Course Irrigation, authored by leading researchers and practitioners, covers a wide range of technical and regulatory topics pertaining to the irrigation of golf courses with wastewater. Water quality, water conservation, regulations, water rights, water delivery, design of systems, monitoring concerns, retrofitting a course for recycled water, and successful case studies are just some of the important topics covered in this informative book. The book includes a comprehensive list of golf courses that currently are using effluent water for irrigation. Golf course superintendents, irrigation consultants, architects, and builders will find this book useful in understanding the many facets of using wastewater for golf course irrigation.

Wastewater Reuse for Golf Course Irrigation is available for $62.25 (includes shipping and handling within the United States) from the USGA Order Department (1-800-336-4446) or Lewis Publishers, 2000 Corporate Blvd. NW, Boca Raton, FL 33431 (1-800-272-7737).

ALL THINGS CONSIDERED

LET'S ALL BE RESPONSIBLE

by PAUL VERMEULEN
Agronomist, Western Region, USGA Green Section

MORE than ever, the daily decisions required of golf course superintendents are being thoroughly scrutinized by the general public. Also, golfers want to know which, if any, hazardous materials have been used that may affect their personal health. For the most part, the standard response to these concerns is to inform golfers that when used according to label instructions, the pesticides used for turfgrass management are safe, and that the results of unbiased scientific studies are available to support such a claim. Furthermore, pesticide applicators go through extensive training and are registered by the state to apply these materials.

Although sharing available information that validates the safety of properly used pesticides is important, I cannot help reminding myself that actions often speak louder than words. Having had the opportunity to visit with golfers across a large segment of the country, I can no longer blame all of the public's concern on the media and its tendency to blow the facts out of proportion. Why? Because on more than one occasion I have witnessed events that make me question whether all of us (turfgrass professionals, and I include myself) are living by the same ethical rules.

Let me cite as a prime example the so-called innocent destruction of earthworms. Personally, I know exactly how disruptive earthworm castings are, and I appreciate the unyielding pressure a superintendent faces to get rid of them. But can a breach of the law and public trust be the right answer? For the sake of argument, let's say that it is. What happens when the public learns that their trust has been ignored to stop a few angry golfers from complaining?

In California the breach of public trust has resulted in the passage of new legislation, the removal of several pesticides from the market, and the denial of new pesticide registration. Now, instead of listening to a few complaints about earthworms, we listen to complaints about daisies in the fairways, summer patch scars on greens, the proliferation of nutsedge, and other problems that can be controlled in other states. Have you heard of Banner, Image, Triumph, and Dimension? None of these new products is available for use in California.

And do you want to know what will happen if someone bootlegs them across the border? They can say good-bye to their state-issued pesticide applicator's license. No license, no employment!

Is it any wonder why so many people are asking the same questions about which pesticides are being used on golf courses? If there is, maybe it's because the actions of a few speak louder than the words spoken by the majority of responsible superintendents. For our own collective benefit, let's commit to being responsible professionals. Don't spray if the material is not registered for what you are trying to control. Sevin is not labeled for earthworms.

USGA GREEN SECTION RECORD
MARCH/APRIL 1994

TURF TWISTERS

TOPDRESSING SAND

Question: We are in the process of growing-in a golf course with greens built exactly to USGA Recommendations. Speakers at recent turfgrass conferences have suggested it's okay to topdress USGA greens with straight sand as long as it's the same or similar to the sand used in the root zone mix. What are your thoughts on this? (Eastern Canada)

Answer: Topdressing properly built USGA greens with straight sand is acceptable if it is the same or very similar to the sand used during construction. Have the sand tested to be sure it is compatible with the original sand.

SHOULD STAY CONSISTENT

Question: I want to be sure my topdressing sand stays consistent from year to year. I can only afford to test it once each season with a soil laboratory. Is there a quick test I can run at the golf course when the sand is delivered to give me a good idea about its consistency? (Louisiana)

Answer: Each golf course should have a set of brass sieves for this purpose. A minimum of seven sieves and the pan is recommended. The sieves should include 2mm, 1mm, 0.5mm, 0.25mm, 0.15mm, and 0.05mm. Remember to shake the sieve stack for approximately five to ten minutes to make sure the finer particles work their way through the smaller sieve openings.

TO AVOID POOR ROOT ZONES

Question: Our golf course will be using reclaimed water next year. I am concerned that my *Poa annua* greens, built on native soil, will not be able to tolerate the additional salts in the water. What are my options? (California)

Answer: Investigate the possibility of supplying potable water to the greens through separate irrigation lines. If this is not feasible, it will be necessary to periodically leach the greens. This may be difficult with native soil greens, and eventually you may need to rebuild the greens with a sand-based root zone material. From a management perspective, be prepared to aerify more frequently and establish more creeping bentgrass on the greens through frequent overseeding. Creeping bentgrass is more tolerant of saline soil conditions.