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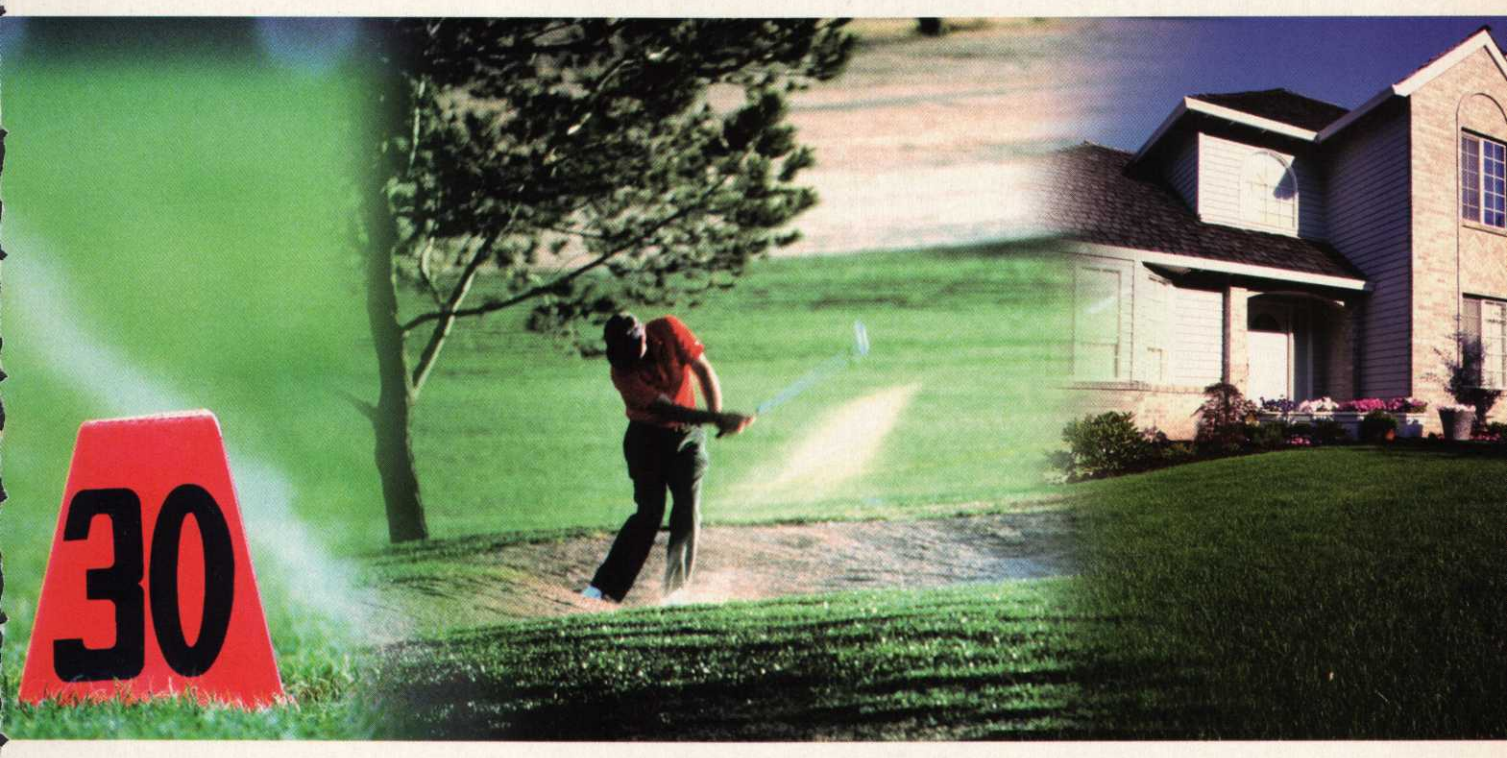

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Superintendents Should Consider Options When Treating Aquatic Weeds

By Stratford H. Kay

The presence of some vegetation is desirable in and around golf course ponds for aesthetics and to provide fish habitat, but excessive plant growth is unsightly and may interfere with the intended use of these ponds.

Weed growth occurs in small ponds primarily because of the presence of clear, shallow water, which permits sunlight to penetrate to the pond bottom, where there are abundant nutrients (particularly nitrogen and phosphorus) that promote weed growth. Ponds on golf courses and in other sites adjacent to high-maintenance turf are very susceptible to colonization by aquatic weeds because of high nutrient availability from the surrounding watershed.

Proper pond location and design, limiting nutrient runoff into the ponds and avoiding planting potentially invasive aquatic plants are the most effective ways to keep aquatic weeds out of ponds.

Aquatic weed management

Two basic types of information are needed to make intelligent aquatic weed management decisions. First, you must know the present and future uses of the pond because these will affect your management options. This is particularly important if you will need to use aquatic herbicides, as all aquatic herbicides except copper-based products have one or more water-use restrictions.

Second, you need to identify the weeds so that you can select management techniques appropriate for your specific problems. Live samples are preferred for identification of most aquatic weeds. Collect your weeds (including roots, rhizomes, vegetative shoots, flowers and seed pods), wash off mud and other debris, wrap them in damp (not wet) paper towels, put them into a zipper-type plastic bag and keep them cool until you can get them identified. Do not leave your samples in a hot vehicle or a container of water (they will begin rotting within 24 hours to 48 hours) or allow them to dry out.

Be sure that the person making the identifications is qualified. Your local extension service office, state fisheries agency, a licensed aquatic applicator or personnel from your state agricultural university usually can assist with identifications and recommend appropriate management techniques.

Several techniques can be used alone or in combination to manage weeds in ponds. Manual techniques are inefficient and labor intensive and usually are not effective for long-term control.

Mechanical techniques remove unwanted vegetation quickly, but are expensive and do not usually provide long-term control.

Cultural techniques modify the environment to make conditions less suitable for weed growth and usually provide longer-term control than either manual or mechanical methods. Biological control usually involves the use of sterile grass carp or other organisms to feed on unwanted vegetation and often provides more cost effective long-term control than other methods. Chemical control involves the application of EPA-registered herbicides and algicides. Effective aquatic weed management usually involves an integrated approach combining two or more of the techniques detailed below.

Mechanical control: Essentially any type of dredging, digging, cutting and mowing equipment can be used to remove unwanted vegetation from ponds and lakes. The main advantage to this method is that the weeds are here today and gone tomorrow, without concerns about herbicide residues in the water, possible water-use restrictions or dead and decaying vegetation in the water.

The disadvantages of this method are that it can be expensive ($10,000 or more per acre if soil removal is involved), and satisfactory control often lasts only a few weeks. Weed fragments also may spread to uninfested areas, and equipment may cause significant damage to the banks of the pond or lake.

Cultural control: Pond dyes are useful in the management of filamentous algae and other submersed (underwater) plants if there is little water outflow and if the pond has been con-

structed properly. These products are nontoxic and do not kill the plants, but simply absorb sunlight that is needed by algae and other underwater plants for photosynthesis. They are safe for use in irrigation ponds and where ponds are used for fishing and livestock. Several dyes are available, including several pond colorants and one or two dyes that are registered with the EPA specifically for aquatic weed control. Dyes generally are not effective on floating plants (duckweed, waterlilies) and emergent plants (cattails and bulrushes).

Water-level drawdown is effective primarily on submersed weeds and, to some extent, filamentous algae. This technique usually conducted on ponds larger than one acre and is done during the winter months when the combination of drying and exposure to cold weather will kill many aquatic weeds. Drawdown normally is not done during the warm months because it stresses fish populations and allows marginal plants to spread. This is a cheap and effective technique provided that your target weeds are susceptible to drawdown.

Biological control: Biological control provides an inexpensive, long-term method of control for certain types of aquatic weeds without the concerns about herbicide residues. Its major drawback is that it usually is slow. The primary biological control agent for aquatic weeds in the United States is the Chinese grass carp or white amur.

Grass carp generally are the most effective and least-costly method for management of most submersed plants in small ponds. They may live for 10 years or longer and achieve weights of 50 pounds or more. Grass carp feed entirely on vegetation and do not compete with other fish in the pond for food.

Stocking recommendations vary somewhat from state to state, but usually fall in the range of 10 fish to 15 fish per acre for small ponds. Fish should be at least 10 inches in length to decrease predation losses by bass and wading birds. Grass carp rarely are effective on floating or emergent weeds or on a few species of tough-stemmed submersed plants in the watermilfoil group. Some states do not permit the use of grass carp. Those which do usually require a permit for their purchase and also require that the fish be certified as being the sterile, triploid form.

Check with your state fisheries or natural resource agencies regarding the use of grass carp since regulations on their use vary from state to state.

Several other biocontrol agents have been used and may be available for control of aquatic weeds. Other fishes include the blue tilapia and the redbelly tilapia. These are stocked at rates of about 250 to 350 per acre and may require a permit. Both are tropical and will not overwinter in areas where water temperatures go below 60 degrees.

Several insects also have been used with varying degrees of success. The alligatorweed flea beetle has been effective on alligatorweed along the Gulf Coast and the southern Atlantic coasts. State and federal agencies may obtain flea beetles for release from the Corps of Engineers in Jacksonville, Fla. More recently, several insects have become available for purple loosestrife control in the northern tier of the United States and southern Canada (contact Cornell University for more information) and for giant salvinia in the southern tier of the United States (contact the Corps of Engineers for more information).

Most 2,4-D formulations are not labeled for aquatic use.

Chemical control: Chemical control is the most commonly used technique for management of aquatic weeds and algae in small ponds in the United States. The advantages of using algicides and aquatic herbicides are that they are easy to apply and that they generally give fairly quick results.

The primary disadvantages are the presence of residues in the water (occasionally also in the soil), the lack of selectivity of some products, and the presence of dead and decaying plants in the water. The use of these products does not pose any significant threat to humans, animals or general environmental health when applied according to label instructions.

Several EPA-registered algicides and herbicides (Table 1) are available for control of aquatic weeds, and many are available in several formulations. Aquatic products include coppe; diquat dibromide; endothall; 2,4-D; glyphosate; triclopyr amine; and fluridone. Each product, except copper formulations, has one or more water-use restrictions following application.

You must realize that all aquatic weed-con-

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trol techniques have some impact on the environment. Most unwanted impacts usually are minor and of short duration. They can be avoided by choosing the most appropriate products and by careful timing of applications. You should not select chemical control as your first choice if other equally effective and more environmentally acceptable options are feasible.

If you are going to use chemical control, be sure that your choice of product or products are appropriate for the weeds present (Table 2) and the intended uses of the pond. Check the label to find out how to use the product, and be sure that it will control your weed problem. It may be necessary to use more than one product when several different weeds are present.

Copper formulations primarily are algicides, although several are labeled for aquatic flowering plants. Glyphosate is used for emergent vegetation and for a few species of floating-leaved plants like waterlilies. Glyphosate has no water-

TABLE 2

Relative effectiveness of different management options on selected aquatic weed species.[1,2]

TARGET WEED	GRASS CARP	COPPER	DIQUAT DIBROMIDE	ENDOTHALL	GLYPHOSATE	FLURIDONE[3]	TRICLOPYR AMINE	2,4-D
ALGAE								
Filamentous algae – most species	NR	G	E	E[3]	NR	NR	NR	NR
Pithophora, Spirogyra, Lyngbya	NR	G	E	E[3]	NR	NR	NR	NR
Macroalgae – Chara, Nitella	E	G	E	E[3]	NR	NR	NR	NR
FREE-FLOATING PLANTS								
Duckweed	NR	NR	G	P	NR	E	NR	NR
Watermeal	NR	NR	NR	NR	NR	G	NR	NR
Mosquito fern (Azolla)	NR	NR	G	NR	NR	E	NR	F
Waterhyacinth	NR	NR	G	NR	F-G	NR	E	E
SUBMERSED (UNDERWATER) PLANTS								
American elodea	E	F	E	E	NR	E	NR	NR
Bladderwort	G	NR	G	P	NR	E	F-G	G
Brazilian elodea (Egeria)	G	G	E	P	NR	E	NR	NR
Brittle naiad (Najas minor)	E	NR	E	E	NR	E	NR	NR
Coontail	G	NR	E	E	NR	E	G	G
Eurasian watermilfoil	P	NR	E	E	NR	E	E	E
Hydrilla	E	F	E	G	NR	E	NR	NR
Parrotfeather	P	P-F	G	G	NR	E	G	E
Pondweeds (Potamogeton)	E	NR	E	E	NR	E	NR	NR
Southern naiad	E	NR	F	P	NR	G	NR	NR
Proliferating spikerush	E	NR	NR	NR	NR	E	NR	NR
Variable-leaf milfoil	P	NR	E	G	NR	E	G	E
EMERGENT AND FLOATING-LEAF PLANTS								
Alligatorweed	NR	NR	NR	NR	G	P	G	P
American lotus	NR	NR	NR	NR	E[4]	P	G	G
Bulrushes	NR	NR	F	NR	E	NR	NR	G
Cattails	NR	NR	F	NR	E	P-F	NR	P-F
Creeping waterprimrose	NR	NR	NR	NR	G	P	G	E
Grasses – most species	NR	NR	F	NR	E	NR	NR	NR
Pickerelweed	NR	NR	P	NR	G	F	G	G
Rushes *(Juncus)*	NR	NR	NR	NR	F-G	NR	NR	P
Smartweeds	NR	NR	F	NR	G	F	P	G
Spatterdock	NR	NR	F	NR	E[4]	G	G	G
Waterlilies *(Nymphaea)*	NR	NR	P	NR	E[4]	G	G	G
Water pennywort	NR	NR	G	NR	F-G	F	G	G
Wateshield	NR	NR	F	F	F[4]	G	F-G	E

[1] All herbicides listed except copper products have one or more water use restrictions following application. These restrictions vary widely with product and formulation. Consult the label for details.

[2] Relative effectiveness: NR=not recommended; E=excellent; G=good; F=fair; P=poor

[3] Note: only the amine salt (Hydrothol 191) has algicidal properties; the di-potassium salt (Aquathol) will NOT control algae.

[4] Care must be taken to prevent splashing and waves to keep the product from washing off the surfaces of floating leaves.

[5] Fluridone requires a long contact time. It should not be applied in areas of significant and continuous water flow. Split applications and/or use of slow release formulations will extend the contact time in areas of slow to moderate water movement.

use restriction, except in drinking water supplies. Endothall is used almost exclusively for submersed weeds, except the amine salt of endothall, which also can be used as an algicide.

Formulations of 2,4-D are used for broadleaf weeds and are effective on the water milfoil group, water lilies and water hyacinth. Most 2,4-D formulations are not labeled for aquatic use. Be sure to check the label and see that the formulation you plan to use is labeled for ponds.

Diquat dibromide is used for submersed weeds, duckweeds (except watermeal), water hyacinth and other free-floating weeds. Triclopyr amine is a broadleaf herbicide which provides good to excellent control of water milfoils, water lilies, water hyacinth and most other broadleaf aquatic weeds that are sensitive to 2,4-D. After use of all of the above products, plant kill occurs quickly and may cause oxygen depletion from the decomposing vegetation in the water. Fluridone is a slow-acting herbicide used primarily for control of submersed weeds, such as hydrilla and Eurasian water milfoil. It is highly effective on duckweeds and is the only product currently available that will control watermeal effectively.

Weeds treated with fluridone take several weeks to several months to die and do not cause oxygen depletion. It is effective on many plants but is nontoxic to humans, fish and other animals. Water-use restrictions for these products vary with formulation, site of application and application rate.

Correct timing of herbicide treatments is important to maximize effectiveness and prevent fish kills. Generally, you should apply herbicides early in the growing season after the water temperature is at least 65 degrees Fahrenheit.

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The plants are growing actively at this time and will absorb the herbicide more quickly. Since fewer weeds are present, you will need less herbicide. Fish kills caused by oxygen depletion also are less likely to occur because the water is cooler and there is less plant material to decay. Perennial plants that form rhizomes should be treated after they flower, so that the herbicide will move down and kill the root and rhizome system.

Most aquatic herbicide applications can be done easily with a hand sprayer, either from the pond bank or from a small boat. Consult the labels for information on the method of application, application rates and specific restrictions for each product. In most states, aquatic herbicide and algicide applications must be done by a licensed aquatic applicator. A permit also may be required. Contact your state pesticide regulatory agency and/or natural resources agencies before purchasing and applying algicides and aquatic herbicides, as regulations may vary widely from state to state.

Kay is an aquatic resources management specialist with Aquatic Research and Consulting in Willow Springs, N.C.

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Upgrades Enhance Operations

New software and controller technology helps superintendents manage irrigation more effectively

BY PETER BLAIS

Advances in software and controller technology continue to benefit superintendents and make them more efficient golf course managers.

"You're never done with software, no matter how much time you spend on it or how good you think it is," says Steve Crain, The Toro Co.'s eastern regional manager for golf of the ever-changing world of computer software.

Toro has added pump-station integration to its SitePro central control system, providing the ability to manage irrigation demand automatically to meet available pump-station capacity, according to company literature. Through partnerships with pump station manufacturers Flowtronex and Watertronics, Toro's SitePro 2.0 allows superintendents to maintain complete control of an irrigation system, even in the event of reduced pump-station capacity.

The pump station notifies SitePro of any problems, such as a lost motor. With this information, SitePro can determine changes in pump-station volume and recalculate irrigation schedules based on a predetermined set of guidelines established by the superintendent.

SitePro can also model different irrigation solutions. Users are given the information necessary to make the best irrigation choices in the event of a reduced water supply. Reporting features provide details on any problems that occurred, as well as confirmation of what areas were irrigated. By helping prevent problems before they occur, Toro says SitePro can save hours of work required to recharge an irrigation system after downtime.

The company relied heavily on

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Upgrades Enhance Operations

Avior, from Signature Control Systems, integrates the irrigation system with software that manages a course's maintenance-vehicle fleet.

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superintendents' input in developing the new system, Crain says. Toro obtained that input largely through its National Support Network (NSN), which handles the company's computer, construction and software training. The company also used internal feedback from its sales, engineering and field-service personnel who have direct communications with superintendents.

Crain likens the upgrade from the previous SitePro 1.1 to the entirely new database in SitePro 2.0 to "opening the hood of your car and dropping in a new engine and transmission." NSN subscribers will receive the new version at no charge.

Improved reliability is one of the major benefits of the new system, Crain explains. For example, the old system required 372 files to back up a course's database. The new system requires one file.

"That data is important because it represents what the superintendent knows about his golf course: infiltration rates, run times, precipitation rates, and wet and dry spots," Crain says. "Backing it up is a big deal. That [fewer back-up files] means a lot less chance of errors or corruption."

The new system includes the Sequential Multi-Manual (SMM) programming feature, formerly available only on Toro's highest-level control system. SMM gives superintendents the ability to build highly specific, high-speed watering programs. "For example, a lot of overseeding, dew and frost removal are done that way," Crain says.

Rain Bird on the watch

Rain Bird recently introduced its Version 4.0 central-control software. The product offers several new features and enhancements, including Rain Watch and Minimum ET, designed to help superintendents maximize water management and conservation practices. Version 4.0 can be installed on all Rain Bird central controls: Cirrus, Nimbus II, Stratus II and Stratus LT.

Rain Watch measures precipitation as it falls and can cancel or pause irrigation. As a result, irrigation systems take full advantage of rainfall while the sprinklers are running. Rain Watch uses as many as four standard tipping-bucket rain cans to measure rain as it falls. Sprinkler run times are adjusted based on the readings.

For example, it can determine whether a rain event is a quick cloudburst or an extended rainy period. During a quick cloudburst, Rain Watch will automatically suspend any running sprinklers while continuing to measure rain. Once the storm passes, irrigation will resume with sprinkler run times reduced by an amount equivalent to the measured rain.

Should the rain turn out to be an extended period of wet weather, Rain Watch will stop any running irrigation

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and prevent new irrigation from starting for a time period specified by the superintendent.

Minimum ET is designed to promote healthy turf and water conservation through advanced evapotranspiration (ET) management techniques. With Minimum ET and a weather station, the watering cycle is determined with specific precision, as opposed to scheduling run times in advance for alternating days.

It allows superintendents to define and set a minimum threshold before automatic irrigation takes place. For example, if the ET is .15 inches and the minimum ET is set at .30 inches, automatic irrigation will not take place until the second day.

Randy Mills, a Rain Bird Golf product manager, says Version 4.0 is the result of superintendent input gained in focus groups and meetings with superintendents throughout the country. The newest version is an enhancement to Rain Bird's existing software product and has been used successfully on pilot projects.

Patricia Mihok, area manager at Gaylord Palms Resort in Orlando, Fla., has overseen one of those projects. She says she's used Version 4.0 for a year and has been happy with it.

"It saves a lot of hassle," she says. "You don't have to keep running back and forth to a controller. You can call on the phone and turn different zones on and off."

Without the system, Mihok says one has to turn down zones manually before the areas get too wet.

"But with this, you can build that information right into the system and the computer does it all," she adds. "As long as you know your property, where the dry and wet areas are, you can set it once every season instead of having to reset it day after day and week after week."

It has also meant significant water savings, Mihok adds.

"Much of our rain comes [unexpectedly] in the evening after we're gone," she says. "Rain Watch took a look at what was going on and shut off the irrigation system on many of those rainy nights. I would have had to leave the irrigation system on all night if we were still watering the old-fashioned way."

As for the Minimum ET feature, she says, "It's allowed my beds to dry out that little bit extra, which can make a big difference in the floral color."

Signature's total integration

Avior is a new software package from Signature Control Systems (SCS) that integrates the irrigation system with software that manages a course's maintenance-vehicle fleet, according to Drew Ferraro, the company's marketing manager.

"We can place a [Global Positioning

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