**Simple boats can be pressed into service** on aquatic jobs, frequently with great success. (photo courtesy Ortho Div., California Chemical Co.)

## Applicator's Manual of Aquatic Weed Control, Part III

# Equipment, Techniques, and Ecological Problems

Results of another *Weeds and Turf* research project

TYPES of application equipment used in aquatic weed control probably vary more than in any terrestrial weed work. Operators may choose very inexpensive outfits for occasional jobs, or very costly systems for constant work.

In many cases, aquatic spray systems are homemade; few companies manufacture a complete rig especially designed for water weed contracts. Applicators purchase pumps, nozzles, hose, etc., and mount these on airboats, barges, and other craft. Some self-designed systems are highly complex and efficient.

To lay the groundwork for adapting spray equipment to water craft, we shall review briefly the various types of chemicals used in aquatic weed control and how they can be applied.

Liquids may be sprayed from a small hand-powered sprayer, from a truck, or from a boat. (Suitable boats will be described later.) Liquids may be poured in concentrated form directly into water from a moving boat. Although some dilution is achieved by diffusion in water, even distribution is minimized with this simple technique.

Liquids which may be irritating to eyes or nose are often dispensed with as little handling as possible. These types are injected into water through tubes which extend below the surface.

Granular preparations may be dispersed by hand, but this method is the least dependable from the standpoint of even distribution. Whirling disc seeder-spreaders make efficient machines to broadcast granules. These may be powered manually or by a motor.

Beginning with the simplest method of application, disregarding applications on foot (or with a hand-pump sprayer), consider the rowboat, skiff, or johnboat. These can be used where granular applications are made either by hand or by a seeder-spreader. These broad-bottomed boats remain relatively stable when loaded with a supply of chemicals. Nonrecreational-type boats, when fitted with a small motor (10 horsepower or less), will serve to apply either granules or spray to ponds and small lakes. Limited carrying capacity makes small boats uneconomical for lakes where refilling stops are necessary.

Some operators have sufficiently large rowboats on which they can mount their pump, motor, tank or drum, and spray boom or gun for easy liquid application.

Since plenty of water is available on lake jobs, many operators with small craft use a screened suction hose to pump water from the lake and concentrated chemical from a drum, mixing the two in the hose and spraying via boom or gun.

This system requires a constant pressure pump since there is no mixing tank and there can be no backflow hose. Gasoline engines generally used range around 4 horsepower. Pumps supply up to 10 gals. per minute with variable pressures. Working pressures are low, and vary from 50 to 100 lbs. per sq. in. High pressure is not needed because the spray target for boom work is not distant. Pressures used should be the lowest possible which will allow complete and even coverage. Higher pressures (up to 200 psi.) may be required for spray nozzle treatment of expanses of floating mats or marginal weeds. Drums full of concentrate are not usually carried upright in a small craft because of questionable stability. Instead, they are laid in the boat on their sides. By tapping the "bung" on the sides, the suction tubes fit in neatly. On small custom boats, mixing tanks may be built in, extending from beam to beam. These may be either steel or lightweight fiberglas. This arrangement gives added stability. Baffles inside sizeable tanks are suggested to help keep an "even keel." When separate tanks or drums are used for mixing, a second pump is required to do the tank-filling operation while the dispensing pump is active. However, a constant pressure pump is not necessary if a mixing tank with an agitator is used, because there can then be a backflow, or overflow, hose to relieve excess pressures.

Chemical is actually discharged either through a boom or with a spray gun. With a suitable valve arrangement, the change from boom to gun application is easy. An orchard gun or a ⅜-inch fire nozzle is usually chosen for manual spraying. Larger nozzle openings reduce chance for drift. A boom can be a 1-inch galvanized pipe mounted on angle iron at the stern. Holes ⅜-inch dia. are drilled 1 ft. apart so that spray streams will hit water at an angle. This also reduces drift.

### Doubled Boats Serve as Barge

An adaptation of small craft for more extensive jobs is seen in the double-hulled platform. By strapping two rowboats together and firmly mounting a platform of marine plywood above them, a barge of sorts results. This platform will carry increased weight and gives workmen room to move about if necessary. Aluminum boats give additional buoyancy and increased portability because of their light weight. A 25-hp. outboard motor will propel the double hull at sufficient applicating speeds.

It is a short step from double rowboats to a barge. Operators get increased buoyancy and carrying capacity although maneuverability is somewhat lessened when a barge is used. With proper rigging, a barge makes an efficient spray platform. Large steel barges 25 ft. long by 8 ft. wide can carry several tons of material if necessary, and are easily propelled by a 40- to 50-hp. outboard motor. Large areas can be treated with no stops for refills. Larger swaths can be treated at one time and total working time is reduced.

Variations of propulsion can be made on many small craft. A few applicators have made successful advances with airdrive boats, those driven by airplane engines and custom propellers which are safely enclosed in a guard. Mounted on a shallow-draft vessel, these propellers can drive a boat over floating or emersed weeds with no danger of fouling motors, as with outboards. Maneuverability is increased in that airboats can stop, turn, and reverse direction in less distance than outboards. Airboats are capable of running right up to the shore because of their shallow draft. They can even ride over wet mud when the water level has been lowered. Airboats can be equipped to apply any form of chemical; booms can be utilized to gain increased coverage per swath with liquid applications.

Large-scale operators have taken to the air and find helicopters highly economical for aerial applications of chemicals, either liquid or granular preparations. The extremely maneuverable helicopter is not handicapped by aquatic or terrestrial barriers and large areas can be treated in a very short time. The chemical is carried in tanks attached saddle-fashion to either side of the helicopter. Gravity normally feeds herbicide granules into an electrically or hydraulically driven whirling broadcaster. Liquid applications are pumped into a boom for distribution. Swaths from 50 to 120 feet may be utilized depending upon the height of application, the quantity of flow, and the type of herbicide used. Although initial cost is relatively high compared to watercraft, faster control over much larger areas is achieved and total costs are less. This is especially true when the timing of application is essential for control.

Monoplanes and biplanes are also used for fast application of liquid herbicides to canals and inland waterways. Fixed-wing aircraft, however, need runways for take-off and landing, and if airports are not near treatment area, valuable time may be lost refilling.

Even distribution of chemicals is part of the key to successful operations. Uneven distribution of herbicides may leave untreated areas which can contribute to reinfestation. Uneven distribution can also lead to insufficient application to areas so that aquatic plants are damaged but not killed. The plants recover as if the herbicide had no effect.

On the other end of the scale, uneven distribution may cause overdose in a particular area and fish-kill may result, leaving a dissatisfied customer.

Even distribution is the most important point to consider when actually applying the chemical. Other considerations, such as timing and dosage (reviewed in the second installment last month) are determined beforehand.

To be certain of even distribution several factors must be evaluated; these factors must remain constant while herbicides are applied.

Chemical concentration must be correlated with the pump and nozzle capacity. These two factors, combined with the operating speed of the applicating craft, determine, in the end, the final concentration of the chemical in the treated water.

Much of this calibrating can be done beforehand also. To determine just how fast a sprayer does work, pumps can be run with water only from a tank of known capacity. After a given amount of time, refill the tank to see how much water has been pumped out. This is the pump delivery for the amount of time the machine has run, usually stated in gallons per minute (gpm).

Determining concentration of herbicides delivered from the pump is not as important when using the double-suction device which utilizes lake water. The concentration which is important is the end concentration of the herbicide in the water body itself or on the foliage of floating or emersed plants. The amount of water used to carry the herbicide is important only in that it helps the operator get better overall distribution, when boom injecting or, coverage, when spraying foli-

This concludes the three-part series of articles on aquatic weed control which was initiated in October. Prepared by the *Weeds and Turf* Staff Biologist, David E. Schneider, the manuscript was reviewed by leading consultants with suppliers and universities, including several experiment stations. We gratefully acknowledge this help.

age. Recommendations are usually stated in so many gallons or pounds of active herbicide per acre or per acre-foot of water. This remains constant no matter how much water is used to deliver the herbicide.

### Pros Use Ecology

Ecology is the study of an organism, plant or animal, in relation to its environment. When we consider the ecology of aquatic weeds and how control is affected by environment, some interesting problems arise. First fact to be noted is that water is the environment for many plants and animals, just as air is the environment for man. Dropping chemicals into the water environment can be like dropping a bomb into man's habitat. The control chemicals must be selective for specific weeds and the operator must know how to use these chemicals in a selective manner (see installment II).

When chemicals are applied for control of floating weeds, it must be remembered that the presence of these surface plants has an effect on other weeds nearby. Some submersed species are suppressed by the shade of floating leaves. If attempts are not made to determine what kind of weeds may underlie floating species, and what will be needed to control them, one infestation may simply be substituted for another.

No job can be undertaken when one knows only the dominant species in the area. Other suppressed species should be sought out and identified so that their control can be taken into consideration.

Ecologic significance can also be attached to animals which inhabit water bodies when weed control measures are applied. Although a chemical may be proved to be entirely nontoxic to fish, these and other aquatic animals may be killed indirectly when the decaying vegetation, which uses up much of the available oxygen, depletes the oxygen supply in a lake. Rapid-acting herbicides should be applied in alternate swaths over a period of time so that fish may escape the oxygen-poor areas. This method is commonly called "partial treatment."

### Fish Need Some Weeds

Another complication is the fact that some fish feed on insects and their aquatic larvae; these insects harbor in and among the aquatic vegetation and in the bottom soil. A client cannot order removal of all of these weeds (to improve fishing) and still expect the fish population to survive in complete absence of their natural insect food supply. Again partial treatment over a longer period of time, a year or more, will keep from starving all the desirable fish. Even with a more complete treatment a follow-up application of fish food will encourage fish survival and growth.

There may be times when substituting one plant for another is advisable. In this case, the applicator should know what weeds are suited to the client's needs. He may suggest removal of an old crop and seeding a new, less objectionable weed to maintain natural conditions. For instance, in a waterfowl lake, it may be desirable to destroy shallow-water submersed weeds and foster growth of emersed plants, such as *Peltandra* sp., seeds of which are a known food for water birds. It could also be desirable to foster growth of erect reedy species which afford shelter for ducks (and hunters).

### Plan to Use Weeds

One very interesting idea that has been cited by expert weed controllers is the use of some emersed aquatic weeds as natural barriers or lane markers. Attempts to remove all weeds (even one species) are impractical and unwise (if not impossible). Therefore, why not make the best use of a controlled crop of weeds, these operators suggest.

On some lakes where there are multiple activities (swimming, boating, water skiing, duck hunting, fishing, and skin diving), and weedy conditions are right, it is possible to maintain some traffic control and keep all of these factions happy. This is done through the planned control of weeds in specific areas, leaving some crops of weeds to act as barriers so that water skiers do not invade the area designated for swimmers or fishermen, and vice versa.

This program, of course, is not short term, but requires much planning and will result in a long-term contract with the client to maintain control as the barriers begin to expand during the second and third year.

It is not really too difficult to assess the needs of each group which uses a lake. Swimmers generally want completely weed-free waters so that divers do not get entangled in submersed weeds. Fishermen need a certain amount of growth to shelter fish but not the submersed types which foul propellers and snag fishhooks. Water skiers want generally clear, open water. Duck hunters in the fall will be able to take over the whole lake but will want some emersed weed stalks in which to build their blinds and some weedy food plants to attract the migrating flocks to their lake.

### Try for Compromise

Scientists will admit that many of nature's complexities still elude them. Imbalances in nature often occur when man misuses resources; sometimes imbalances occur for no apparent reason. In light of human error, scientists attempt to study nature and solve problems by reaching a compromise of "nature's scheme" and man's desire to utilize resources.

The job of a professional weed controller is not simply to do what the customer says he wants done. Rather, he should appraise the situation and advise (in light of the customer's desires) what approach would be best for his needs according to how he wishes to use the water.

Applicators thus become knowledgeable consultants able to do the control work when required, but also able to show customers what should be done and why.

A body of water used for recreational or esthetic purposes is useless if it is nearly sterile. What the professional applicator wishes to do is to halt or confine the biological succession of flora which would eventually turn the lake into a swamp and finally back to dry land.

### Consult with Client

Decisions on which stage of development to maintain in a lake or pond rest with the applicator (and in some states with government officials who must be consulted and who supervise operations). When all factors are considered—degree of infestation and species involved, desired future use of the water, and other animals dependent upon the body of water and their desirability in that particular body—only then can the operator decide upon an approach and agree with the client about a price for the job.

One can see that aquatic weed control is not a service to be entered into lightly. Thorough study of weeds and control chemicals is needed to be competitive. Preparations must be extensive, and risks are high. But the complexity of the challenge is surpassed by the po-

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**Aquatic Weed Control**
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tential in financial return, and successful aquatic weed controllers find that their services are indispensable and continually called for by those who love, use, and thrive on water resources.

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## Southern Weedmen Gather Jan. 15-17 in Jackson

Nearly 500 weed control personnel from all phases of the industry will gather in the Heidelberg Hotel, Jackson, Miss., Jan. 15-17 for a varied program for weed controllers in industry, public works, and agriculture.

Dr. E. G. Rodgers of the University of Florida, Gainesville, is in charge of the program, and will furnish more information to those who desire it.