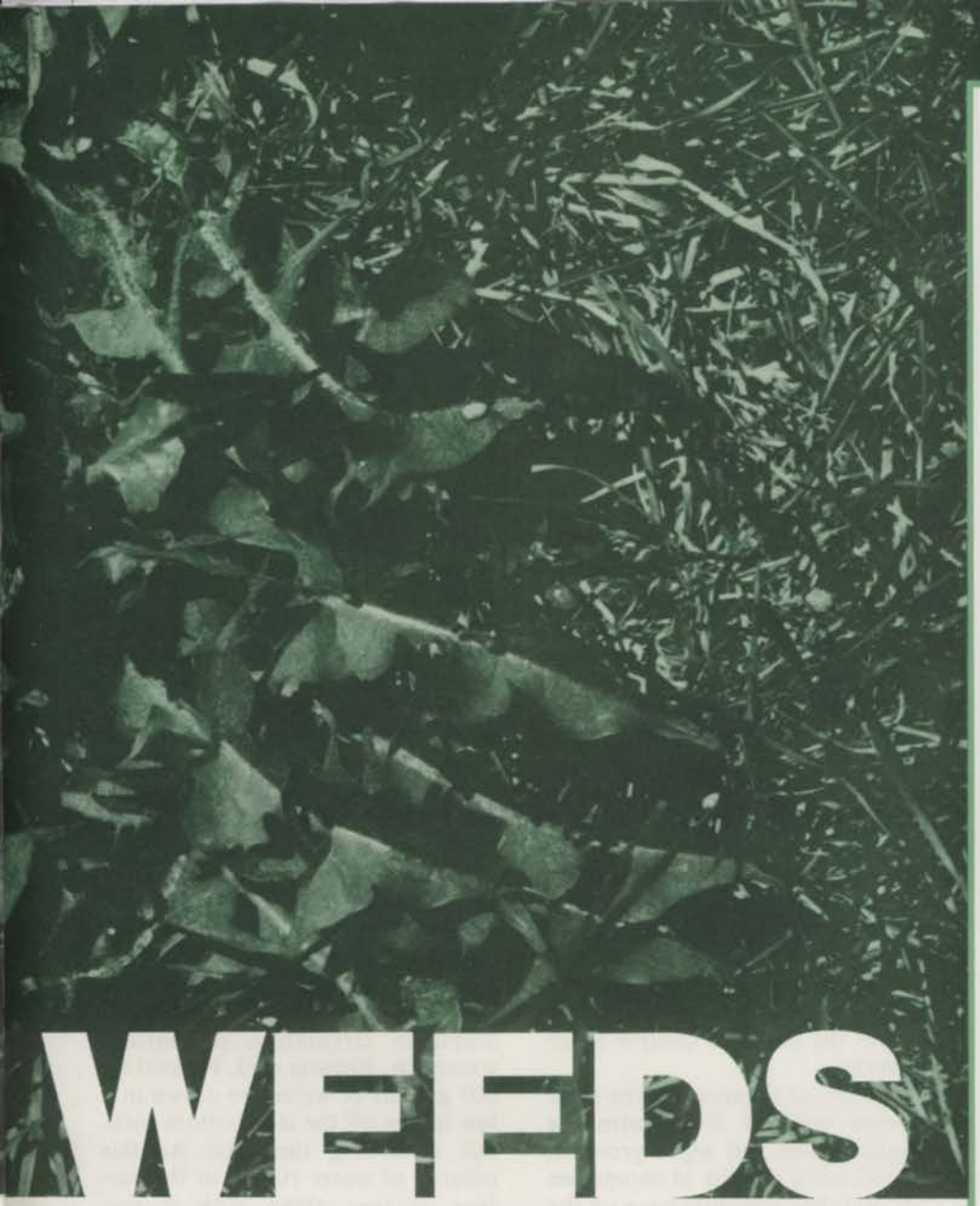

WEEDS

BANVEL®+2,4D

herbicides...

Herbicide and Broadleaf Weed Susceptibility

Weed	2,4-D	Silvex	Meco-prop	Dicamba
Bindweed	S	S-I	S-I	S
Bittercress	S	S-I	S-I	S
Black medic	R	S-I	I	S
Buttercup	S-I	I	I	S
Carpetweed	S	S	S	S
Chickweed, common	R	S	S-I	S
Mouse-ear	I-R	S	S-I	S
Chicory	S	S	S	S
Clover, crimson	S	S	S	S
Hop	I	S	S	S
White	I	S	S	S
Cranesbill	S	S-I	S-I	S
Daisy, oxeye	I	I	I	I
Dandelion	S	S	S	S
Dock	I	I-R	I-R	S
Dogfennel	I	S	I	S
Garlic, wild	S-I	R	R	S-I
Ground ivy	I-R	S-I	I	S-I
Hawkweed	S-I	R	R	S-I
Henbit	I	S	I	S
Knapweed, spotted	I	S-I	I	S
Knawel	R	S	I	S
Knotweed	R	I	I	S
Lambsquarter	S	S	S	S
Lespedeza	I-R	S	S	S
Mugwort	I	I-R	I-R	S-I
Mustards	S	S-I	I	S
Nutsedge	I	R	R	R
Onion, wild	I	R	R	S-I
Ornamental plants	S-I	S-I	S-I	S
Woodsorrel	R	S	R	I
Pennycress	S	S-I	I	S
Pepperweed	S	S-I	S-I	S
Pigweed	S	S	S	S
Plantains	S	I	I-R	I-R
Poison ivy	I	S	R	S-I
Pony foot	S	I	I	S-I
Prostrate spurge	I	I	I	S
Purslane	I	S-I	R	S
Red sorrel	R	I	R	S
Shepherdspurse	S	S	S-I	S
Speedwell	I-R	I-R	I-R	I-R
Spotted spurge	I-R	I	S-I	S-I
Thistle, musk, curl	S	I	I	S
Thistle, Canada	I	I	I	S
Vegetables	S	S	S	S
Wild carrot	S	S-I	S-I	S
Wild strawberry	R	I	R	S-I
Yarrow	I	I-R	I-R	S
Yellow rocket	S-I	I	I	S-I

S = weed susceptible; I = intermediate, good control at times with high rates, sometimes poor, usually require more than one treatment; R = resistant weeds in most instances.

Chart reprinted by permission, S. Wayne Bingham, Ph. D.

"Two" is better!

Some weeds simply aren't affected by single herbicide treatment. But Banvel +2,4D has an "additive effect" in that the two herbicides get weeds that one alone just weakens.

Banvel herbicides—products for professional turf men

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Aquatic Weed Control

There are three forms of aquatic weed control — mechanical, biological and chemical. Various mechanical methods can be employed, including pulling, raking, digging, skimming, cutting, lining, shading, draining and dredging. Equipment costs can range from practically nothing to an investment of thousands of dollars.

Biological controls include fertilization of ponds to produce algae blooms which shade out rooted vegetation and increase fish production; the white amur, a fish that has been introduced experimentally as an aquatic weed and algae eater; a large crayfish species, *Orcanectes causeyi,* which feeds on living and dead plant material; and the lily weevil, an insect being used in some areas of the South to control water hyacinth.

The use of chemicals is the most common method for controlling nuisance weed and algae growths. The following is a list of companies and what they presently have on the market for this area of weed control.

Aquazine, manufactured by Ciba-Geigy Corp., Greensboro, N.C., is relatively new on the market. It is an algicide-herbicide used to control algae and submerged weeds in ponds. The company said it has low toxicity, and because of this there are no fishing restrictions after application. It is effective against pond plants at very low concentrations. Its low solubility helps to assure its complete dispersion throughout the pond by natural water movement, according to product manager Bob Austin.

While some chemicals kill plants immediately on contact, Aquazine is gradually absorbed, he said. When treatment is made at a five to 10 percent infestation level, the sudden deposit of dead algae and weeds is avoided, and this minimizes the danger of extreme oxygen depletion brought about as a result of massive decomposition.

The chemical will provide control of algae and weeds for a full season, depending on the degree of infestation and on climatic conditions. Where the warm season is long and water temperatures remain high, it may take more than one treatment to maintain full-season algae control. The company said Aquazine controls algae and aquatic weeds by inhibiting the photosynthetic process after being absorbed by the plants.

Kembro, Inc., Mequon, Wis., manufactures the GenAIRator, a system of pond bottom aeration designed by company president Dr. Mervin F. Browne. The unit's Venturi chamber jet plume action amplifies circulation of bottom water, Dr. Browne said. He said 6,000 gallons of water are drawn in a few inches off the lake bottom without disturbing the lake. As this column of water rushes to the surface, it tugs along with it surrounding waters, so wind action is constantly saturating enormous quantities of bottom water with oxygen.

3M Co., St. Paul, Minn., manufactures five products in this area, according to Robert E. Morrow, sales supervisor of aquatic products and services.

Mariner brand liquid copper algicide System A is an aqueous solution of a copper-triethanolamine complex. It is useful in controlling many species of plankton and filamentous algae in lakes, ponds, canals and waterways. 3M brand aquatic herbicide System E is a compacted formulation of endothall which is for controlling a variety of aquatic weeds growing in non-moving water. The product is applied to infested areas in pellet form. The pellets disintegrate into fine particles and the endothall is

released from the particles over a period of hours. Morrow said it controls coontail, elodea, hydrilla, pondweed, water buttercut, water-milfoil and widgeongrass.

Mariner brand aquatic herbicide System L contains endothall exchanged into a carrier system consisting of hydrous aluminum oxide. It controls species of hydrilla, naiad, pondweed, coontail, elodea, water-milfoil and widegeongrass.

Mariner brand aquatic herbicide System M is a wettable powder containing 55.8 percent copper in a form said to be effective in controlling chara and many species of filamentous algae in nonmoving water. It is applied as an aqueous suspension.

Mariner brand Blue Pond Dye enhances the natural beauty of pond water while concealing undesirable conditions like plankton algae, sediment and decaying vegetation. It is for use in ornamental ponds, golf course water holes and other small, water-containing areas.

Great Lakes Biochemical Co., Inc., Milwaukee, Wis. manufactures four products in this area.

Slow Release Algimycin PLL-C is a copper-based pelleted formulation for controlling attached and branched algae, especially chara and nitella. Algimycin PLL-C is a concentrated water soluble liquid aglicide of chelated copper which remain soluble over a wide pH range. It can be used with simple spray equipment or by metering directly into the fresh water supply. It can be sprayed on the water directly on floating mats of algae or injected below the surface.

Algimycin PLL is a less-concentrated formulation of chelated copper for precise dosage in small ornamental ponds.

Algimycin GLB-X is a wettable powder specifically formulated to control and prevent the growth of most algae and similar slime producing organisms found in small ornamental ponds.

Dr. Robert M. Stern of the company explained to WEEDS TREES & TURF how weed and algae control was handled recently at Meequon Municipal Golf Course in Wisconsin.

"The irrigation lake at the course posed two problems," he said. "First and most important was that the presence of large amounts of aquatic weeds and algae caused a clogging of the water intake, and secondly, the obnoxious appearance and malodors given off by decaying materials was undesirable. We also had the problem that any chemicals added must have no harmful effect on the turf."

Since the body of water had a heavy infestation of aquatic weeds and algae, it was necessary to treat for both, he said. After an identification of the types of aquatic weeds and algae growth were made, a three-step program was devised. The weeds were treated with a silvex-endothall mixture. Immediately after treatment for aquatic weeds, chelated copper in the form of Algimycin PLL-C was applied to the same area directly on the mats of the algae. Two weeks later, after most of the weeds and algae were killed and had decomposed, the same area was treated with Slow-Release Algimycin PLL-C pellets to control further growth of algae.

"Initial treatment for weeds and algae was made late in June and treatment with Slow-Release Algimycin PLL-C was made in early July," he said. "Most visible algae

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The H-650 Harvester for aquatic weeds from Aquamarine Corp.

AQUATIC *continued*

growth and weeds had disappeared 12 days after the initial treatments. Algae was controlled successfully for the remainder of the summer around the inlet areas."

Aquamarine Corp., Waukesha, Wis., has two systems of mechanical aquatic weed harvesting, according to R. M. Stair, vice president of sales. The first is the Aqua-Trio. This consists of a harvester, transport and shore conveyor. The harvester cuts a swath of aquatic weeds eight feet wide and up to five feet deep. It can operate in water only 18 inches deep. The capacity of a hold on the unit is 650 cubic feet.

When the harvester hold is full, the transport is mechanically mated with the harvester and the load is transferred by the live bed of the harvester to the live bed hold of the transport. At the shore, the transport is mated mechanically with the shore conveyor that loads the cut weeds into a waiting truck or stack.

The company also manufactures the Sawfish, a marine front end loader. It operates on the same principle as the trio, but with smaller quantities and is a single unit. Stair told WEEDS TREES & TURF aquatic herbicides are "ecologically a disaster. We have a whole ecosystem to consider, and we don't really know that much about what happens. The decaying process of dead weeds consumes oxygen that is vital to the body of water, and you do not have this process with mechanical weed harvesting."

Phelps Dodge Refining Corp., New York, manufactures Triangle Brand Copper Sulfate. It is available in large crystals similar to those of rock salt, and also in very fine crystals like table salt. Each form has its particular uses in algae and weed control, the company said. For controlling algae, it is most practical to spray algae growths with copper sulfate that has been dissolved in water.

More copper sulfate is needed to destroy weeds than to destroy algae. For this reason, the use of copper sulfate as a weed killer may be dangerous to fish life. It is not recommended for destroying those weeds which have floating leaves or those which stick up above the water.

The most practical method for treating submerged weeds with copper sulfate is to use the large crystals.

Applied Biochemists Inc., Mequon, Wis., manufactures Cutrine-Plus and Weedtrine. Cutrine-Plus controls filamentous and planktonic algae, the company's Robert

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Senninger said. It can be applied with regular spray equipment in its liquid form. In its granular form it controls chara, nitella and other algae that grows on the bottom. It can also control spirogyra, cladophora, vaucheria, ulothrix, microcystis and oscillatoria.

Weedtrine-D is an aquatic weed killer in recreational areas, around boat docks and long shorelines. Senninger said early in the season, when weeds have not yet reached the surface, apply Weedtrine-D by pouring directly from the container into the water throughout the infested area. In late season, he said, where weed growth has reached the surface, it may be poured from the container, injected below the water surface or sprayed on the water surface.

Thompson-Hayward Chemical Co., Kansas City, Kan., manufactures a number of aquatic management products, according to Bob DeCicco, manager of marketing services.

For submersed rooted aquatic plants, the company manufactures Casoron G-10, a herbicide also registered for the rooted algae, chara, in non-flowing waters. It is in granular form designed to sink to the bottom where the chemical is absorbed into the plant root system. It controls elodea, northern water milfoil, naiads, coontail, chara and pondweeds.

For emersed aquatic plants, endothall is the basic ingredient for three aquatic herbicides manufactured by the company. Aquathol-Plus combines contact and systemic action for the control of 25 weed species.

Ded-Weed Silvex LV is a control for submersed and emersed weeds. Best results are obtained when used before plants begin to flower. It is effective in control of alligatorweed.

Algaetrol 76 can control a broad range of algae including chara. Apply it when algae growth first becomes visible and water temperatures are above 60° F., the company said.

Air-Lec Industries, Inc., Outdoor Products Division, Madison, Wis., manufactures an aquatic weed cutter, according to Henry M. Ebbot of the sales and service department.

The unit cuts weeds in waterways and along shorelines. Ebbott said it is highly maneuverable and can work close to piers at the edge of the water. By keeping a forward speed of the recommended three to six miles an hour, quite an area can be covered in a few hours, he said.

Once cut, the weeds should be removed from the water and there is a rake attachment available for that purpose. While the rake can be mounted with the cutter, it is a much faster and more efficient operation to have the rake mounted on a separate boat, by using an auxiliary rake frame. Ebott said the cutter can keep three or four rake boats busy.

National Hydro Systems, Inc., West Chicago, Ill., manufactures the Hydro Systems Aerator, according to that company's Jim Baranyi. The unit is a floating aerator that keeps the algae level down by pumping

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water up in the air to add oxygen. It is recommended for golf courses, small lakes, public parks, industrial lagoons, farm ponds, and recreation sites.

Chevron Chemical Co., San Francisco, Calif., manufactures Ortho Diquat Water Weed Killer. Ronald G. Gras of the company said it is water-soluble and presents no hazard to fish populations when used according to label instructions. It can control bladderwort, coontail, elodea, naiad, pondweeds, water milfoil, pennywort, salvinia, water hyacinth and water lettuce, duckweed, cattails and certain filamentous algae.

Amchem Products, Inc., Ambler, Pa., manufactures a number of aquatic products, according to Robert C. de Wilde, marketing manager of industrial chemicals for the Agricultural Chemicals Division.

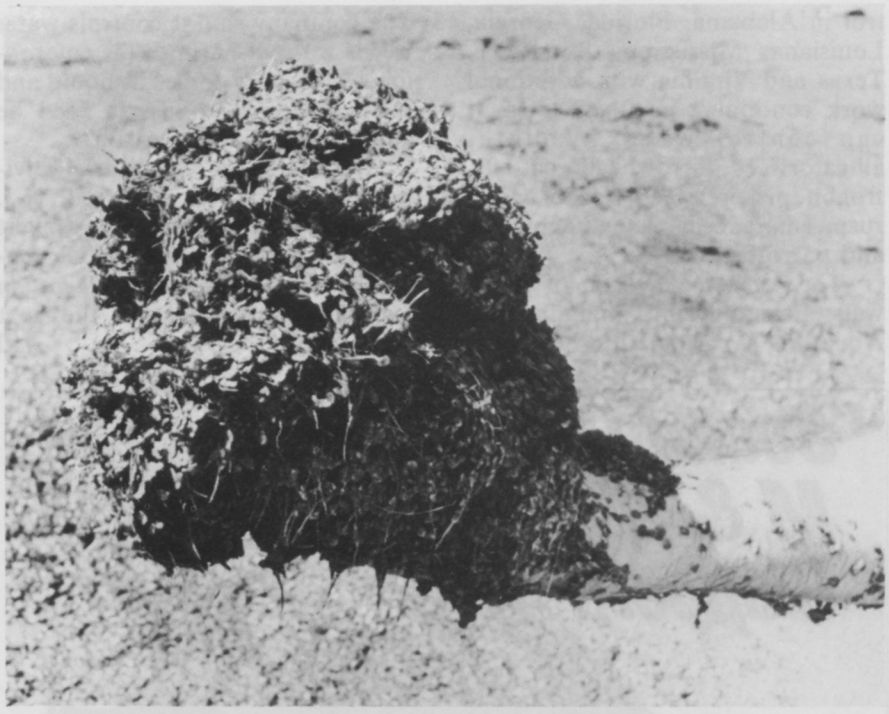
Aqua-Kleen contains 20 percent by weight of 2,4-D acid equivalent. Its granules sink to lake or pond bottom and release the weed killing chemical in the critical root zone of submerged aquatic weeds. The granules do not readily dissolve in water and the chemical is released slowly. Applications can be made to coincide with rapid growth of root systems. Early spring applications are more effective on most weeds than are summer or fall treatments. Susceptible weeds are water milfoil and water stargrass. Slight to moderately resistant weeds are bladderwort, white water lily, yellow water lily or spatterock, water shied, water chestnut and coontail.

Amitrol-T liquid herbicide can control cattails, phragmites and water hyacinths. Emulsamine E-3, an oil soluble amine form of 2,4-D, can control water hyacinths. Weedar 64 can control water hyacinths. Weedone, 2,4,5 TP can control alligatorweed. Fenac can control American pondweed, leafy pondweed, sago pondweed, waterthread pondweed, American elodea pondweed, southern naiad, water stargrass, coontail, milfoil sp. and slender spikerush. Weedone LV-4 can control cattails and tules.

Velsicol Chemical Corp., Chicago, manufactures Banvel-720, which has intrastate label registrations for aquatic plant control in Alabama, Florida, Georgia, Louisiana, Mississippi, Tennessee, Texas and Virginia with additional work continuing in other states. It can control water hyacinth, alligatorweed, arrowhead, cattails, frogbit, pickerel weed, slender spikerush, smartweed, water pennywort and parrotfeather.

The Agchem Division of Pennwalt, Fresno, Calif., manufactures Aquathol K, an aquatic herbicide. The company said it controls water weeds without harm to the environment or fish. It comes in liquid and granular formulations. It need be applied only once a season.

Rhodia Inc.'s Agricultural Division in Monmouth Junction, N.J. manufactures the Visko-Rhap invert emulsion system, a herbicidal control system, explained in *Operation Duckweed,* beginning on the next page. □



Operation Duckweed

This time last year, Alabama's Black Warrior River and boating and swimming enthusiasts among its summer cottage residents were at the mercy of duckweed — four to five feet thick in some areas. It will be different this summer.

by Charles L. Hargrove
Agricultural Division
Rhodia Inc.

For several summers the Black Warrior River in central Alabama had become increasingly choked with a pesky proliferous aquatic plant known as duckweed. But next season its waters will be clear again due to the effectiveness of an invert emulsion means of herbicidal control in "Operation Duckweed".

Until three or four years ago, the river was very popular with Birmingham-area residents for weekend and vacation fishing and boating. Many have summer cottages along the river, and fishing camps abound.

But, by the summer of 1974, the river was essentially dead. Mile after mile of its water surface was carpeted with a lush, green, "wall-to-wall" cover of duckweed, several feet deep in some places. This made it impossible to use the infested waterways for motorboating and fishing. Most of the fish camps suffered severely, and many had to close down for the season.

Although public complaints had been building over the previous few years, the explosive growth of the duckweed in 1974 finally precipitated intensive activity by state and national environmental agencies.

Apparently duckweed, which incidentally was not indigenous to the region, became established in the lagooning area, called Bayview Lake, several years ago. Until recently, however, it had not spread beyond that. But early in 1974 a spring drawdown was made and duckweed proliferated in the Black Warrior River during the summer. It reached epidemic proportions far downstream by midsummer, producing in some places a surface layer as much as four to five feet thick.

Above: Duckweed growth consists of myriad individual plants which form a choking mass, cutting off light and oxygen and endangering fish life.

Besides interfering with boating and fishing, this blanket of plant life cuts off oxygen and light to the river. Consequently, it kills the fish population and results in interruption of the natural aquatic cycle.

Government enters picture. The Alabama Water Improvement Commission (AWIC), along with the regional federal Environmental Protection Agency (EPA) office in Atlanta, had become very active in seeking a solution to this problem. Experience elsewhere suggested the solution would not be easy.

The individual duckweed plant is tiny and innocuous. An individual trefoil plant only about a quarter of an inch across, it has three hair-like roots an inch or so long. But the plant proliferates so rapidly that waterways become choked by masses of these individual plant units. Though they are separate plants and not interconnected, their population increases so fast that they create what appears to be a solid mass of plant life.

Normal types of herbicidal treatment do not function efficiently because of a tendency for the active herbicide to disperse in the water. Those solutions or conventional (oil/water) emulsions quickly become too dilute to be fully effective. Applying high enough concentrations can help counterbalance this effect, but it pushes the cost beyond economic feasibility. Also it creates unacceptably high residual levels of herbicide in the water.

After the 1974 crisis, the Awic and EPA called upon Dr. Robert D. Blackburn, a plant biologist, to find a practical solution. Formerly research leader for the U. S. Department of Agriculture's Aquatic Plant Management Laboratory (Ft. Lauderdale, Fla.), Dr. Blackburn had recently joined his wife (Candy Joyce Blackburn) in a specialized consulting firm, Joyce Environmental Consultants, Inc. (Casselberry, Fla.), to handle weed-control problems such as this.

Invert emulsion recommended. From his years of experience with similar aquatic infestations, Dr. Blackburn proposed to use a special combination of herbicides in an invert emulsion as the most productive way to

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