How Maryland Uses "Manatee" to cut WATERCHESTNUT

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WATERCHESTNUT has infested Maryland tidewaters since World War I. It first became a real nuisance about 1923 when a large patch was observed in a Potomac River tributary near Alexandria, Va. By 1933, an estimated 10,000 surface acres were covered, posing such a hindrance to navigation that Congress allotted funds for waterchestnut control. The appropriation, however, covered only the Potomac River and its tributaries. Waterchestnut has since been found in some upper Chesapeake Bay tributaries, but these infestations are held in check by the State of Maryland.

Waterchestnut Has Great Reproductive Potential

Waterchestnut (*Trapa natans*) is an annual and grows only from seed. Each seed may produce as many as 10 or 15 rosettes, which float on the surface like water lily leaves. Each rosette, in turn, can yield as many as 15 or 20 seeds. This gives the plant a great reproductive potential, which, fortunately, is seldom realized.

Sometimes, the rosettes are so crowded they cannot lie flat on the water; the leaves are crammed together and stand upright. Even in less dense areas, boating, fishing, and swimming are impossible. It is very difficult even to paddle a canoe through a thick bed of waterchestnut.

Rosettes consist of up to 50 toothed leaves crowded together on the thickened, stalklike end of each branch. Leafstalks (petioles) are long and swollen with spongy tissue. Flowers grow on short stalks at the base of some of the leaves, the lower flowers producing seeds while the upper ones on the rosette are still in the bud stage. The heavy seeds begin to ripen and drop from their stalks in mid-August; they sink immediately to the bottom and sprout the following May.

The seed sends out a stolon from which several stems sprout, and each stem may branch several times. Stems are tough and slender, $\frac{3}{16}$ in. thick, and may grow as long as 15 ft.

Clusters of rosettes from a single plant may cover an area 10 ft. in diameter if they are not crowded. Green submersed leaves grow opposite each other on the stem. Their needlelike leaflets are borne on midribs sometimes as long as 8 in. The long roots of waterchestnut are rose-colored, unbranched, and sprout from the underwater stems at the nodes.

Fully matured seeds, about the size of hickory nuts, have four sharp barbed spines, which are strong enough to penetrate thin shoe leather. When dead, the seeds float and often congregate

Waterchestnut leaves float on the surface, hindering navigation and water sports.

"Manatee", underwater weed cutter, clips waterchestnut 8 in. below water surface. Conveyors dump harvest into a large basket that holds over 100 cu. ft. of the water weed.

at beaches, creating a barbed hazard for barefooted swimmers.

We are not certain how the plant spreads. Rosettes cut from their stems carry seeds for long distances, but an abscission layer, or break joint, that would allow rosettes to break free from the underwater stem without some severe disturbance hasn't been found. The spread of new plants, though, indicates that seeds are waterborne, probably on the rosettes. New infestations are usually found in the very shallow water at the top of marshy areas or in thick beds of aquatic weeds. The barbs on the spines can very easily attach to animal fur, and this may account for the spread of the plant to some areas.

Maryland authorities are concerned about lasting control of waterchestnut because the plant can thrive at depths of 15 ft., even after the rosettes have been cut off.

Extended Controls for Twelve-Year-Old Seeds

Because waterchestnut reproduces only from seed, it is possible to eradicate the species from an area by destroying the plants before they have set seed. However, the seeds can remain alive for at least 12 years, which means that complete control is necessary for that long. To date, most control measures have been mechanical, but testing with various chemicals is underway.

The first control attempts were made by the Corps of Engineers in the Potomac River back in the early 1920's. Rosettes were cut from their stems and allowed to float in the tidal currents to salt water, where they were apparently killed. Rosettes were cut with commercial and homemade weed cutters, and after 10 years of annual cutting, the infestation was reduced to a very low level. But the species was never completely eliminated from the Potomac system. The Corps still sends a crew of men into the field each year to hand-pull whatever plants they can find. In the summer of 1965, they pulled 41 plants, roughly the number removed annually by hand for the last six years.

In 1955, large patches of waterchestnut were discovered in the Bird River, a tributary of the Gunpowder River. The Maryland Departments of Game and Inland Fish and Tidewater Fisheries initiated a program to control the floating pest in the Bird River. Both Hockney underwater cutters and 2,4-D were used. After seven seasons of work, the project ended with the weed seemingly eliminated.

Then, in 1964, several large patches covering two or three acres were again discovered in the Bird River, and a rather severe crop of waterchestnut turned up in the Sassafras River. The greatest concentration was in Turner's Creek, a tributary of the Sassafras. A limited effort was made in the summer of 1964 to control the chestnut with cutters and chemicals, but previous commitments prevented an all-out effort at that time.

"Manatee" Joins the Team

In 1965, a full-scale project began to eradicate waterchestnut from the Sassafras water system. An aquatic weed harvester and transport barge were purchased from the Aquatic Controls Corp. of Hartland, Wis. The harvester, dubbed the "Manatee," is carried on an 8 ft. by 20 ft. barge. Its cutting head is 10 ft. wide and adjustable to depths down to 4½ ft.

A series of wire-mesh conveyor belts dumps the cut weeds into a large basket at the back of the craft. The basket, which holds more than 100 cu. ft., is emptied onto the deck of the transport barge. This 8 ft. by 24 ft. barge also has a conveyor belt that runs along the deck and feeds an elevator belt at the bow, enabling us to dump the cut weeds into a truck or on shore above high tide. The Manatee can enter and leave the water under its own power since its front wheels are power driven, both machines being

Waterchestnut first became a real problem in Maryland tidewaters in the early 1920's. Infestations spread under incomplete control measures until it took an all-out effort, here described by author Elser, to harness the weed and clear the waterways.

equipped with wheels for towing over land.

The Manatee cuts waterchestnut best when the cutter head is lowered about 8 in. into the water. Since a mass of rosettes is rather fluffy and unmanageable, some fall back into the water, so we have a skiff follow the harvester to pick up overboard plants.

Harvest Storage: a Problem

At first, we carried the cut weeds on the transport barge from the Manatee to the shore where they were dumped above the high tide line. However, we couldn't stack the plants out of reach of the next high tide, which carried some away again. It became necessary to hold the cut rosettes at a dump site. Because of the large area vulnerable to new infestation, and because floating rosettes carry seeds for long distances, we installed a semicircular chicken wire fence along the shore for a dump area. But, at very low tide we couldn't get close enough to the fence to deposit the plant material, and at very high tide some of the plants drifted over the top of the barrier. We then tried snow fencing that was formed into a circle and pushed into the mud floor of 2-ft.-deep water. At very high tides, however, the entire mass of plants floated over the top of the fence.

Eventually, we found a satisfactory solution to the disposal problem. We made a square frame of 2 by 4's, 12 ft. long, and nailed a 50-ft. roll of snow fence on the outside of this with the fence staves extending 1 ft. above the framework and 3 ft. below. Placed in the water and anchored by a stake, the bin formed a "bottomless pit" capable of containing an enormous amount of plant material.

When a mass of plants is confined in the pit, it dries on top and rots on the bottom in the water. In about a day, the plant mass is reduced to only a fraction of its original volume. This process allowed us to fill the pit every day. In spite of its almost infinite capacity, several of the "bottomless pits" were built since, on days when cutting was going well, a single bin could become overloaded. Plant material could not escape from above or below the bins because they followed the high or low water level. After two or three weeks of drying and rotting, the plants became so tightly matted that we could anchor the plant mass by staking through its center into the bottom of the stream. The bin was removed and the weedy flotilla left to rot while we used the bin at another operating site.

"Bottomless pit" proved the solution to disposing of the harvest. Disposal bin of snow fence tacked to a 12 ft. square frame rides with the tides and has an almost limitless capacity. Cut, trapped weeds rot in two to three weeks, then bin is removed.

Single Plants Picked With Ten-Foot Pole

Waterchestnut infestations vary in size from single, widely scattered plants to dense mats covering many acres. The Manatee can work efficiently only on the large patches, because the machine is too clumsy for sharp maneuvering where plants are scattered. The solitary plants are best controlled by hand pickup. This operation is just what it seems, that of picking the rosettes by hand, generally with the aid of a rake or other tool. We found the best tool was an apple picker at the end of a 10-ft. pole.

Three two-man crews worked on waterchestnut pickup during the summer of 1965, with one of these following the Manatee and the others handpicking. The crews used 16-ft., flat-bottomed boats made of plywood. Boats had no center seat so that large loads could conveniently be carried. They were powered with 9½-hp. outboard engines, which were mounted on adjustable transoms and rigged with weedless propellers. With these craft, we were able to cut through heavy weed beds and travel through as little as 3 in. of water.

Infestations too scattered for the Manatee and too dense for hand pickup presented a problem difficult to solve. We tried a smaller cutter, the "Manette" by the same maker, which cut the waterchestnut very efficiently, but wasn't equipped to remove weeds from the water. Finally we compromised: we used the Manatee on patches that were really too small for it and handpicked even moderately large patches. We are now planning to use a custom-made cutter designed for operation on the in-between infestations.

Rosettes Seed After Cutting

To see if rosettes would continue to develop after they were cut from the stem, a "bottomless pit" was used to confine tagged rosettes in the water. We found that plants which were cut before the blossoms had matured continued to develop and produced normal seeds. These results con-

firmed experiments that have been carried out in New York State and justified the use of "bottomless pits" to keep rosettes from floating away after they were cut.

Plant Shows Fourfold Annual Increase

In 1964, we were able to work only some two weeks on the waterchestnut problem. Of 100 acres in the Sassafras River system, we cut about 30 acres in Turner's Creek at that time. By June 1965, only scattered plants marked the areas cleaned out in 1964, whereas the uncut areas were covered with dense mats of waterchestnut. We estimated that the infested area increased about four times in the untouched portions of the creek. If this was an accurate estimate, it indicates that three-fourths of the chestnut must be destroyed each year just to hold an infestation at status quo.

Salt May Halt Regrowth

In mid-July 1964, new growth appeared at the surface less than a week after cutting. These rosettes were small and did not set seed. In 1965, however, there was almost no regrowth. We think that the salt content of the water may have prevented regrowth in 1965, although we were not able to detect salt in any part of the Sassafras system. Frequent measurements by various agencies show that salt content of the Chesapeake Bay has been increasing for three or four years; by September, salinity in one fresh-water area on the Susquehanna flats had reached three parts per thousand (ppt.). In August, we found rather heavy sets of barnacles in most of the tributaries of the lower Sassafras, and these barnacles cannot survive in water with less than 4 ppt. salt.

On waterchestnut we had not yet cut, the outer leaves of rosettes turned brown and fell off. Many of the stems rotted and remaining rosettes floated away with their seeds. In the summer of 1965, we cut some 180 acres of chestnut; the salt water intrusion, we believe, finished the job for us.

Need More Data on Pesticide Risks, Maryland U. Conferees Are Advised

"We have some information on the risks involved in the use of pesticides, but we need more," Dr. J. E. Dewey, of Cornell University, Ithaca, N.Y., told delegates to the Sept. 27-28 Northeastern Arborist-Nurserymen's Pesticide Application Conference at the University of Maryland, College Park.

Dr. Dewey noted that continued employment of pesticides is a must, but cautioned that the safest chemical that will do a given job adequately should be used. He called for increased emphasis on the use of sprays rather than dusts, and on use of more carbamate and organic phosphate pesticides which leave less residue than some others.

Attended by more than 75 arborists, nurserymen, pesticide coordinators, and others, this was the third in a series of custom applicator schools sponsored by the University of Maryland and the Northeastern Pesticide Coordinators.

Program speakers included Dr. John A. Weidhaas, Cornell University entomologist, who talked on "The Chemical Aspects of Shade Tree and Nursery Insect Control"; Horace Webster, National Park Service plant pathologist, who described municipal pest control in the Capital region; Dr. Charles W. McComb, University of Maryland entomologist, who headed a session on "Recognition of Some Important Insects of Shade Trees and Their Control"; Dr. Edward Duda, of Bartlett Arboretum, Stamford, Conn., who discussed "Hydraulic Application of Pesticides"; and Dr. James L. Brann, Jr., Cornell University entomologist, who covered "Some Factors Affecting Air-Blast Sprays."

Highlight of the two-day meeting was a guided tour of the 415-acre National Arboretum, in Washington, D.C. Participants viewed plant research projects and discussed measures used at the Arboretum to control pests of trees and shrubs. Anyone interested in additional information on the conference series should contact chairman David Shriver, chemical-pesticide leader, Department of Entomology, University of Maryland, College Park, Md. 20742.

Centrifugal Spreader Gives Speedy Broadcast

The Diadem centrifugal fertilizer spreader is capable of broadcasting all types of fertilizers, lime, seed, granular herbicides and insecticides with precision in one-fifth of the time ordinarily required, according to The Vandermolen Co., North Caldwell, N.J., which has introduced the equipment in the U.S.

Diadem can cover up to 12 acres per hour with even swaths of 35 ft. and more, Vandermolen says. Spinner disk, scoop blades, and feed outlets are designed and matched to provide uniform placement of all types of material. Tractor speeds up to 10 m.p.h. can be used, and a simple adjustment will vary coverage from 9 lbs. to 2,600 lbs. per acre.

The Diadem spreader's conical steel hopper has a 700-lb. capacity. Spinner assembly and setting controls can be removed without the aid of tools for quick cleaning of parts. For complete information and illustrated literature on the equipment, which is manufactured in West Germany, write to The Vandermolen Co., 378 Mountain Avenue, North Caldwell, N.J. 07006.

Diadem centrifugal spreader holds 700 lbs. of fertilizer, seed, or herbicide, spreads at speeds up to 10 m.p.h.