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Control of

AQUATIC AND DITCHBANK WEEDS

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AS MORE AND MORE LAND IN CALIFORNIA goes under irrigation, the problem of controlling aquatic weeds becomes increasingly important. These weeds spread through irrigation ditches and drains, preventing adequate water delivery and causing drainage systems to fail. They clog lakes, streams, and ponds, interfering with swimming and fishing. They increase water losses from evaporation and seepage. And they sometimes contribute excessive amounts of organic matter to domestic water supplies.

Several mechanical methods, and numerous chemicals have been developed for the control of these weeds. The advantages and drawbacks of each type of control are discussed in this circular.

That chemical control is proving most satisfactory is shown by the pictures on this page. Top photo shows an irrigation ditch before treatment. Note weeds which clog the ditch and restrict flow. Lower photo shows the same ditch—clean one day after treatment with one of the new chemicals.



Control of

AQUATIC AND DITCHBANK WEEDS

ALDEN S. CRAFTS

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Types of Aquatic Weeds

1. Submerged aquatics. These weeds are normally attached to the bottom of the ditch, and actually grow beneath the surface of the water. They cause the most trouble from the standpoint of reduced water flow in irrigation ditches.

The most common submerged aquatics are: sago pondweed (*Potamogeton pectinatus*; also called horsetail moss or angel's hair); horned pondweed (*Zanichellia palustris*); hornwort (*Ceratophyllum demersum*; also called coontail moss); stonewort, *Chara* species; water milfoil, *Myriophyllum* species; and water weed (*Anacharis canadensis*).

2. Emerged aquatics. This type of weed is rooted below the surface, but the plant rises above the water line. These weeds also have a wide distribution and do a great deal of damage. Besides hindering the flow of water, they encourage mosquito propagation, thus adding to the mosquito control problem.

The most common ones are: tule, *Scirpus* species; cattail, *Typha* species; bur reed, *Sparganium* species; sedge (*Cyperaceae*); rush (*Juncaceae*); arrowhead or duck potato, *Sagittaria* species; burhead, *Echinodorus* species; and water plantain, *Alisma* species.

3. Surface aquatics. Some of these float freely on the water, while others are attached to the sides or bottom of the ditch and float only in a fixed area.

The following are a few examples: yellow water weed (*Jussiaea californica*; water primrose); water hyacinth (*Eichhornia crassipes*); water lettuce (*Pistia stratiotes*); broad-leaved pondweeds, *Potamogeton* species; parrot feather (*Myriophyllum proserpinacoides*); and pennywort, *Hydrocotyle* species.

NOTE: Perennial grasses, such as Bermudagrass, ditchgrass, and crabgrass, often grow profusely in irrigation ditches. These are not, strictly speaking, aquatics, but they interfere with the flow of water.

Mechanical Methods of Control

Dredging is probably the commonest method of cleaning weeds from drains and ditches. A dragline dredge may be equipped with a bucket or with a weed fork or other special tools. While the bucket dredge will do a fairly thorough job of getting out most of the weeds, it will also take out a lot of mud in the

process. The weed fork will drag out plant growth, but leave most of the mud behind. Usually, the more effectively the weeds are removed, the more likely the mud is to be removed along with them.

Dredging has been the only available method for many ditch cleaning jobs until recently, but it has many drawbacks:



Dredge being used on thick growth of tules in ditch.

1. It can be used only in open ditches.
2. The ditch must be accessible from at least one side.
3. It usually enlarges the ditch, and may change its carrying capacity.
4. It may deepen the ditch so that water stands in the bottom and encourages growth of cattails and tules.
5. It usually leaves a bank or ridge of "spoil" (mud and weed growth) that must be spread if the underlying land is to be used.
6. It is a slow process.

7. It is expensive. The cost depends upon volume and type of weed growth, and upon the size of the ditch. Weed forking of a particular ditch may cost \$100 per mile. Ridding the same ditch of cattails or tules might require draglining at a cost varying from as low as \$10 to as high as \$1,000 or more per mile. In some situations, a single dredging may last several years; in others, dredging may have to be done once a year or oftener if full water capacity is to be maintained. Furthermore, because of the cost, dredging is usually delayed until the weeds are fairly thick, so that the ditch seldom functions at its full capacity. Ditches must

therefore be built oversized to insure sufficient water delivery—an expensive and inefficient practice.

About the only advantage to dredging is that it removes all types of weeds equally effectively.

Drying is a simple, inexpensive, and very satisfactory method for use on submerged aquatics. In districts where water can be withdrawn and the ditch bottoms drained, the tops of under-water weeds will dry up after several days' exposure to sun and air. If clumps of weeds clog the ditch bottom, a plow may be used to open a furrow so that the water will drain away.

The principal drawbacks to this method are that it is ineffective against emerged weeds and some of the floating species, and it requires interrupting the use of the ditch, often during critical dry periods in summer.

Hand-cleaning of ditches is used in many regions, often being carried on in winter when farmhands are not otherwise occupied. The men cut and remove the accumulated weed growth with heavy knives and hooks. Cattails and tules that



Burning ditchbank weeds with power equipment. Long boom reaches both banks.

are dense and dry are burned. Willows are often slashed and burned along with other dead vegetation that occupies the banks. While such methods provide much work for men who might otherwise be idle, they involve an immense amount of heavy, tedious labor, and if paid for at current wage rates, are very costly.

Burning is one method of weed control that works for both aquatic weeds and the dry-land species that infest the banks above the water line.

Many irrigation districts have developed weed control programs that include burning. For example, conditions in the Imperial Valley are such that weed growth is continuous throughout the year, and burning is one of the principal methods being used by the Imperial Irrigation District. In 1945, 1,677,024 gallons of oil were used to burn 18,208 miles of ditches. In 1946, 10 units were in operation, each consisting of a 4-wheel-drive truck mounted with a 900-gallon tank. Each unit has a 1-inch pressure pump and 1½-horsepower engine. These pumps develop around 100 pounds per square inch, with 24° gravity fuel. This equipment employs a 30-foot boom mounted on a movable base located on top of the

fuel tank and counterbalanced for ease of operation. From two to six nozzles are used, depending on the size of the ditch being treated. Adjustment of the length and form of the boom can be made in the field.

Recently, the Imperial Irrigation District has put several new units into service. Each of these consists of a 6-wheel-drive truck mounted with a 1200-gallon tank, and has a No. 10 Bean pump, 2-horsepower engine, and 35-foot boom. The unit operates at 400–500 pounds per square inch with a considerable increase in efficiency.

Among the many weeds constituting a problem in the Imperial Valley are tules, cattails, and willows, that grow in the water, and cottonwoods, bamboo, arrow weed, wild asparagus, and a host of annual weeds that grow on the ditchbanks. Experience in this district has proved that best results are obtained by first searing the green vegetation and following in 10 to 12 days with complete burning. In searing, a hot flame is passed over the vegetation at such a rate that the plants wilt but are not charred. Searing kills many plant cells which, in dying, release toxic substances that injure all tissues above ground. These tissues dry

rapidly and after about 10 days, burn freely from their own heat. The burner is used only to kindle the dry material and to burn the more resistant species. Tules and cattails are eliminated by two years of consistent burning; willows, cottonwoods, and perennial grasses are discouraged but not completely destroyed. Bamboo requires more drastic treatment.

Chaining is a relatively inexpensive method which is widely used. A heavy chain is attached between two teams or tractors on opposite banks of the ditch. As these move, the chain drags over the weeds and breaks them off. Chaining is generally not done until a ditch has become severely clogged, which means that, as with dredging, the ditch operates efficiently for only short intervals after each chaining.

This method is most effective for removing submerged aquatics. If all the vegetation is not broken loose the first time, running the chain back in the opposite direction is usually successful.

In controlling cattails, tules, bur reed, arrowhead, burhead, and other emerged species, repeated chainings may be necessary.

If chaining is to be really successful, a consistent program must be followed. Old growth must be removed at the beginning of the season, and chaining should then be done whenever new shoots rise a foot above water level. When such a system has been followed regularly, weeds have been eradicated in a single season.

There are several disadvantages to the chaining method:

1. Manpower. In addition to the crew operating the chain, four to 20 men are usually required to remove loosened vegetation from the ditch. (This may be done with pitchforks or, as in some districts, with power-operated forks.)

2. Chaining will not eradicate weed growth above water, on the ditchbank.

3. In newly or sparsely infested ditches, chaining breaks up submerged aquatics which then float down the stream, spreading the infestation.

4. Chaining stirs up silt, wears away the ditchbank, and may seriously damage cement or Gunitite linings.

5. Cleaning cannot be done near the structures, particularly where reverse chaining is necessary.

6. Some water weeds tend to wind around the chain and make it ineffective.

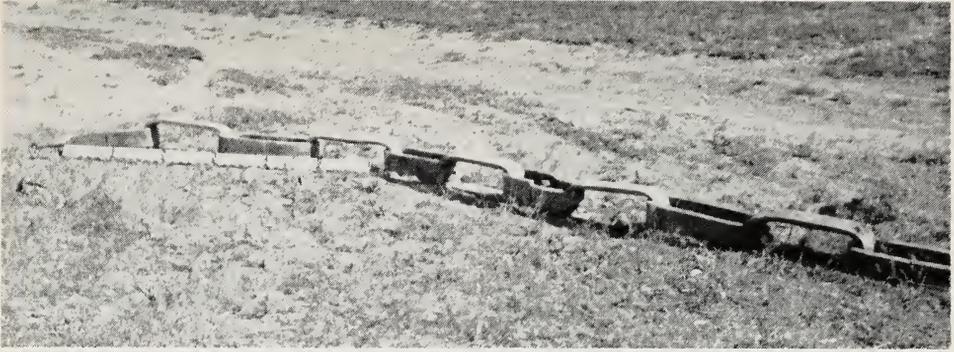
7. Both ditchbanks must be passable.

8. Because of headgates, turnouts, and other structures, a certain amount of hand-cleaning is required to supplement chaining.

In addition to dredges and chains, there are numerous other devices for cleaning ditches, such as special dredgers, disks, revolving knives, mowing machines, and saw boats. Most of these are useful, but some may change the depth or shape of the ditch, others may stir up the sediment which is useful in helping reduce seepage. They may be difficult to maintain mechanically and, generally, through the years, they only partly relieve the costly and tedious job of cleaning.

Pasturing. This is a very popular method in regions where livestock are raised on irrigated pasture. Fencing is usually required, and in some soils, trampling of the banks may be a serious problem. But this method is economical and effective in many districts. Forage crops are planted along ditchbanks to compete with weeds and to promote clean grazing. For an excellent discussion of pasturing and planting, see "Control of Weeds on Irrigation Systems" (1949), a publication which may be obtained from the Bureau of Reclamation, U. S. Dept. of the Interior, Washington, D.C.

Mowing is another popular method for control of ditchbank weeds. When fol-



Top: heavy chain used for dragging through ditches. Center: chain fastened between tractors is being drawn along ditch bottom. Lower: weeds being forked out of ditch after chaining.

lowed by burning, it gives satisfactory control of annuals and seasonal perennials. It has not proved satisfactory where perennials such as willow, tamarisk, and bamboo are involved. Mowing can only be done on smooth, unobstructed banks. Special mowers are required for sloping banks.

Disking is also used in many districts, but it has become less popular since the

introduction of chemical controls. This method tends to lower the angle of the banks so that they must eventually be reformed—a problem which makes disking impractical where soils are sandy. In fact, in such regions, disking or plowing of ditches may deplete the colloid in the soil to a point where relocation of the ditch becomes necessary. In such situations, concrete ditch linings or chemical weed control may be the best solution.

FOUR COMMON



← **Coontail.** This submersed plant never develops roots. It usually moves about in the water, though sometimes the ends of its stems are buried in the silt.

Anacharis, commonly called "Waterweed," reproduces from sections of plant which break off and form new roots. The leaves are sometimes tinged with purple.

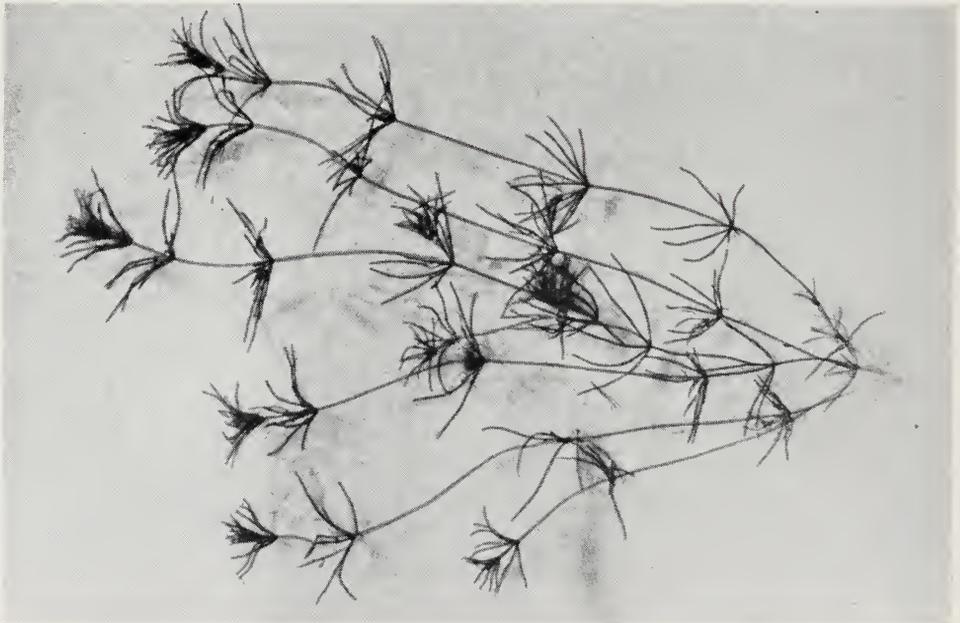


AQUATIC WEEDS

Sago pondweed is one of the worst weeds infesting irrigation ditches. It reproduces by seeds, by creeping roots, and also by small tubers. →



↓
Muskgrass, or *Chara*, is an alga, grayish-green in color, and often encrusted with lime. It spreads by means of spores and broken pieces of stem.



Chemical Methods of Control

Many chemicals are now available for use as weed killers, all of them effective if applied to the right weeds at the right time. The operator's problem is one of knowing what materials to use and where, when, and how to use them intelligently.

Sodium arsenite is the traditional "weed killer" that has been used for years to control general weed growth. It is still one of the cheapest and most effective chemicals for control of ditchbank weeds. It may be used where there is no danger of its poisoning stock or pets. It can be used as a spray on young weeds or as a sterilization treatment on the soil. Arsenic trioxide is also useful as a soil sterilant on ditchbanks.

Sodium chlorate as a spray or as a soil treatment is useful against perennial weeds. On vegetation, it forms an inflammable mixture. It should be used with caution.

Trichloroacetic acid (TCA) is a new herbicide. The sodium and ammonium salts of this acid are very toxic to grasses, and less toxic to some broad-leaved weeds. TCA is being used to kill Johnsongrass, Bermudagrass, and quackgrass. It is most effective as a spray when it is washed into the soil by rains after being applied to the tops of weed growth. It is a valuable addition to our list of herbicides as it does not sterilize the soil for a long period.

Contact sprays may be used on all emerged weed growth above the water line, and on common ditchbank weeds. These sprays include: diesel, smudge-pot, and other fuel and waste oils, and special commercial products, such as Pentox Weedkiller #2, Shell Weedkiller #20, Avon Weed Killer, Chapman-Gilbert Weedkiller #5, Cox Hykil Weed Oil, Foothill Oil Weedkiller, General Weed Exterminator, G & H Weed Oil, Harold



Failure to control tules may result in a completely clogged ditch such as this.



Hand-spray equipment being used for applying Benoclor to parrot feather.

Preston's Weed Oil, Home Oil Anaheim Weed Killer, Kem Kill W, Richfield A, Union 40-60 Distillate, and others. Fortified oil emulsions involving oil, carriers, toxic fortifying agents, and emulsion stabilizers may also be used. A useful formula for a pentachlorophenol concentrate contains $\frac{1}{2}$ pound of pentachlorophenol and $\frac{1}{2}$ pound of oil-soluble emulsion stabilizer per gallon of aromatic oil. This concentrate may be emulsified with water to form a toxic contact spray. Mixtures containing 4 to 20 gallons of concentrate per 100 gallons of spray are useful. Such commercial products as Dow Contact herbicide, Dow General, and Sinox General herbicides may be used to formulate fortified oil emulsion sprays.

Solutions of a number of salts, including sodium arsenite, sodium chlorate, ammonium thiocyanate, ammonium sulfate (Ammate), and ammonium trichloroacetate, may be used as general-contact sprays. The latter is particularly toxic to grasses.

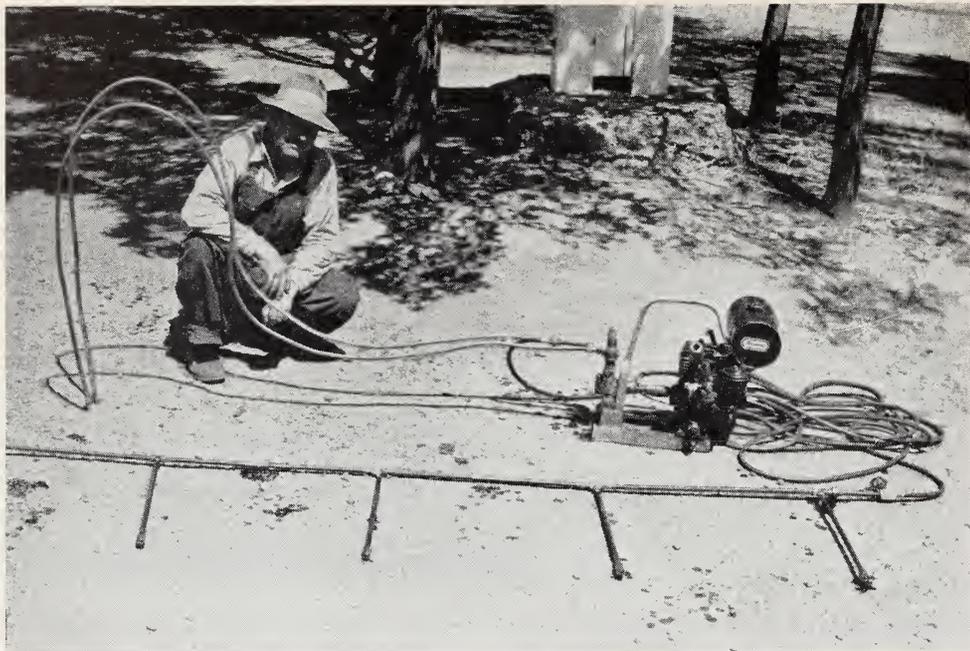
The choice of contact spray will depend upon the weed species present, cost and availability of the chemicals, crops being

watered, etc. These problems are discussed in detail in University of California Agriculture Extension Circular 137, "General-contact Weed Killers."

2,4-D. This hormone weed killer is proving valuable for control of water hyacinth, water primrose, pennywort (*Hydrocotyle* species), *Sagittaria*, and *Alisma* species, and other floating and emersed water weeds. It is also useful to control water hemlock, milkweed, and other poisonous species often found on ditchbanks and in drains. The ester forms of the chemical are most effective on the waxy leaves of aquatic plants, but because it is highly volatile in this form, 2,4-D should not be used near sensitive plants, such as cotton, tomatoes, black-eyed peas, sweet potatoes, etc. The amine salts are less volatile, but they, too, should not be allowed to contaminate water which may be used on susceptible crop plants.

Willow, cottonwood, tamarisk, arrowweed, and others, are common ditchbank weeds which may be killed by 2,4-D.

A new chemical, 2,4,5-T, is proving useful to control wild rose, blackberries,



Power equipment for applying aromatic solvents to ditches. Two or more small-orifice nozzles are better than one large one for even distribution.

poison ivy, and other woody plants on ditchbanks.

Benoclor. Algae in streams and lakes have long been controlled with copper sulfate, but aquatic species of higher plants required a stronger chemical. The first chemical to give this necessary control was Benoclor, a preparation containing chlorinated benzenes plus emulsifying agents. Two types of this chemical are available—Benoclor, and Benoclor 3C. The chemical is a heavy liquid that readily disperses in water to form a milky emulsion. In flowing water, Benoclor 3C, a highly stable form, must be used so that the emulsion will not break while moving over distances up to 3 miles. In lakes or ponds, the less miscible form, Benoclor, is usually used. It settles to the bottom where it continues to act on weeds without tainting the water.

The application involves forcing the liquid through spray nozzles under a pressure of around 30 pounds per square inch. When the emulsion comes into contact

with aquatic weed growth, it is absorbed by the plants and they are injured and, in many cases, killed. In treating moving water, a simple gear pump and nozzle system may be used. This rig remains stationary and the water may be treated as it flows past. In static water, the pump may be moved along the ditch, or for treatment of lakes, it may be mounted in a boat. Salts or organic matter in the water apparently have little effect upon the killing action of Benoclor. Animal life, including fish, crayfish, frogs, and mosquito larvae, is killed in treated ditches. But injury to fish in lakes may be prevented by careful treatment of narrow strips of vegetation. Benoclor will not injure wildlife or stock.

Benoclor has been most effective against submerged aquatics in irrigation and drainage ditches. Applications are made after spring and early summer growth begins to cut the flow of water.

The action of the chemical is rapid, and the normal carrying capacity of the

ditch is usually restored within 24 hours. Dosage depends upon the weed species present. Generally, all submerged aquatics will be killed if exposed for 1 hour to a concentration of 300 parts Benoclor 3C per million parts water, by weight. Around 40 minutes are required at 600 ppm; 2 hours are required at 150 ppm. (Benoclor 3C weighs approximately 11 pounds per gallon; water weighs 8.3 pounds.) This dosage amounts to approximately 6 gallons of chemical per hour applied in a stream of one cubic foot of water per second. If the operator knows the cross section of the ditch and the speed with which the water moves, he can calculate the rate of application required to provide the necessary 300 parts per million.

Application of Benoclor 3C is relatively simple. The most satisfactory unit is a 1½-horsepower, air-cooled, gasoline engine directly connected to a 3-gallon-per-minute gear pump. This equipment will pump a volume sufficient for several nozzles at a pressure of 80 pounds per square inch. To prevent overheating, the pump should have a by-pass valve set at 80 pounds, designed to return excess chemical to the spray tank. For the first application, nozzles with 0.040-inch orifices are spaced about 2 feet apart on a boom which lies on the bottom of the ditch. The nozzles should point upstream at an angle of 45 degrees from the bottom of the ditch. Applications may be made at stations lower on the ditch, using the same boom with nozzles having 0.020-inch orifices.



If location permits, the boom may be suspended from a bridge, as shown above. Note how chemical forms a white emulsion in water.

Where extremely high volumes are needed (as in a deep ditch or one of high velocity), larger orifices may be used, or the nozzles may be spaced closer on the boom. Nozzles should produce flat fan sprays horizontal with the boom.

A common method of treatment is to reduce the flow of water in the ditch. This lowers the water level, and concentrates the weed growth. The first application is then made near the head end of the ditch, with enough chemical to make a dense white "blanket" (about 300 ppm) for a period of one hour. Once this blanket has been established, the pumping equipment is moved down the ditch to a point where the blanket is beginning to thin out (150–200 ppm). The distance depends upon the thickness of the weed growth through which the chemical has passed, and is usually at a point 1 to 1½ miles from the start of the application. At that point, more chemical is added at a rate sufficient to build the blanket up to its former density. Usually about 50 per cent of the original amount is required. This treatment, with the reduced amount of chemical, may be prolonged to a period of about 1 hour by using 0.020-inch nozzles in place of the 0.040-inch ones used at

the beginning of the treatment. The process is repeated at stations on down the ditch. The last application is made one mile above the last turnout. This allows enough time for the water to clear so that it will be harmless to crops. The water can be spilled into a drain or other channel at the end of the ditch.

Benoclor 3C may be used to treat areas of static water of almost any size larger than a few square rods. For water in motion, the faster its flow, the longer will be the run that can be treated economically. The time of exposure to the chemical, and its concentration, are the critical factors. Benoclor is being widely used in ponds and along lake shores wherever aquatic weed growth interferes with swimming, boating, fishing, or the domestic water supply.

Aquatic weeds vary in their response to Benoclor treatment. Stonewort, horned pondweed, and waterweed are three that are easily killed. Sago pondweed, coontail moss, and water milfoil are intermediate in response. Parrot feather is somewhat more difficult to kill, and requires a surface spray of 1 gallon per square rod of 50 per cent Benoclor 3C emulsion in water. Water-line and sur-

Aromatic solvent being applied in irrigation ditch. Note angle of the nozzles.



face weeds are even more difficult. In treating cattails, tules, sedges, and rushes, the plants must be cut below the water line and just above the soil surface. This is expensive, but it results in a clean ditch or lake which will remain weed-free for a long time if the treatment is successful. Cattails and tules have been killed by treating the same day that they were cut. Treatment must be made during spring or early summer (up to August 1) while weed growth is still rapid. These weeds cannot be controlled above the water line with Benoclor. In some instances, yellow water weed, ditchgrass (*Paspalum distichum*), sedges, and rushes have been killed, but higher dosages are required.

An additional advantage of Benoclor is that it kills plants rapidly so that instead of clogging near the surface, they break up and sink to the bottom where they decompose. Thus the expense of forking the heavy growth out of the water (necessary with mechanical methods of control) is eliminated.

Solvent naphtha. This is a new material that promises to give effective control of submerged aquatics at very reasonable costs. Solvent naphtha is obtained from either coal tar or petroleum, and is used commercially as a paint thinner. Chemically, it resembles somewhat the structure of Benoclor.

In order to keep naphtha in a stable emulsion for use as a weed killer, an oil-soluble stabilizer must be used with it. Mahogany soap, at 5 per cent by volume, is recommended for this purpose. It should be thoroughly dissolved in the naphtha before application. Since the term "mahogany soap" is applied broadly to petroleum sodium sulfonates of different types, the product should be bought under a trade name, such as Oronite wet-

ting agent, Ortho emulsifier, oil-soluble Santomerse or Span, or any similar standard stabilizer. The oil companies are testing various mixtures containing both naphtha and a stabilizer, some of which are already available for aquatic weed control. Experience shows that temperature affects the stability of emulsions of solvents in ditch water. The Bureau of Reclamation recommends using 10 per cent emulsifier for waters below 70° F, 7.5 per cent for waters between 60° and 70° F, and 5 per cent for waters above 70° F.

In early experiments with naphthas on aquatic weeds in ditches, the recommended treatment was a concentration of 185 ppm, on a volume basis, for one hour. This is equal to 5 gallons of chemical per cubic foot per second of flow applied during one hour. This amount was sufficient for the control of some weed species, but in the Sacramento Valley, much higher concentrations were required to control sago pondweed. The experiments were conducted with Socal #2, using Ortho emulsifier as a stabilizer, in a ditch having an initial capacity of 75 cubic feet per second. (Flow during the treatment was reduced to 5 cubic feet per second.) The weeds had cut down the capacity of the ditch by about 50 per cent. Treatments at 600 to 700 ppm killed *Anacharis* and *Chara* species, but gave only about 50 per cent injury on mature sago pondweed. Treatment at 1400 ppm killed sago pondweed if the blanket was reinforced each mile at a rate equal to 500 ppm. This required about 160 gallons for the first mile, and 53 gallons for each additional mile.

Use the following formula for finding the concentration of the chemical, applied in parts per million (ppm), of any chemical used:

$$\frac{\text{Gals. chemical} \times \text{wt. of chemical per gal.} \times 1,000,000}{\text{cu. ft. per sec. flow} \times 62.4 \times 60 \times \text{minutes applied}} = \text{ppm}$$

Example: Benoclor (11 lbs. per gal) is to be applied in a ditch having a flow of 1 cubic foot per second:

$$\frac{6 \times 11 \times 1,000,000}{1 \times 62.4 \times 60 \times 60} = \text{approx. } 300 \text{ ppm}$$

A recent publication of the Bureau of Reclamation recommends application at the rate of 300 ppm for 30 minutes. Because water temperature, weed species, and other factors are involved in these treatments, it is suggested that preliminary trials be run before extensive treatments are made with solvent naphtha.

Naphthas suitable for use as aquatic weed killers are lighter than water, and must be thoroughly mixed to insure good distribution in the ditch water. If the emulsion breaks, the naphtha floats to the top and evaporates. (This is in contrast to Benoclor, which sinks to the bottom and apparently remains somewhat active.)

Since naphthas vary in their chemical make-up, they also vary in toxicity. Because of this, any naphtha to be used for aquatic weed control should be tested in a small area before being used in quantity.

Although concentrations ranging from 600 to 1400 ppm may be required, treatment with naphtha is relatively inexpensive when compared with dredging or hand-cleaning. The price range is 18 to 40 cents per gallon, with an average of 30 cents for petroleum products. Commercial products combining naphtha and an emulsifier are available at a somewhat higher price.

CAUTION: Naphthas are highly inflammable. Never use them near an open flame. Even the gas which remains after the drums are emptied will explode if ignited. Naphtha fumes are reported to be toxic to waterfowl.

In buying solvent naphtha for use in aquatic weed control, look for the following specifications:

Flash point °F not less than	80
A.S.T.M. D-86 distillation °F:	
Starting point	278
Not more than 10 per cent at	286
Not less than 90 per cent at	395
End point not higher than	420
A.S.T.M. D-875, aromatics per cent, not less than	85

The author wishes to acknowledge use of photographs loaned to him by the Bureau of Reclamation, Department of the Interior, which appear in their publication, "Control of Weeds on Irrigation Systems" (1949), and of photographs supplied by B. B. Boyer, representative of the Cloroben Corporation, Jersey City, N.J.

In order that the information in our publications may be more intelligible it is sometimes necessary to use trade names of products or equipment rather than complicated descriptive or chemical identifications. In so doing it is unavoidable in some cases that similar products which are on the market under other trade names may not be cited. No endorsement of named products is intended nor is criticism implied of similar products which are not mentioned.

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J. Earl Coke, Director, California Agricultural Extension Service.