Amchem Aquatic Weed Control Program

By

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At the Fourth Annual Hyacinth Control Society

The increased demands on our limited water supplies have created in all of us a greater awareness of aquatic weed problems. On one side is the cry that we do something about these water weeds that interfere with our way of life — whether business or pleasure. On the other side of the coin is the fear of the unknown. Don't do anything that will be harmful to us, our children, our pets and livestock, game birds and animals and specifically, the fish that inhabit the waters to be treated.

This, then, is the dilemna of the company producing aquatic herbicides: how to formulate a herbicide which will be safe for all concerned and will still kill weeds.

A few years ago it was possible to introduce a new herbicide into the field of aquatic weed control just as soon as field tests indicated weed-killing activity. Today, though, it is far more complicated. Too many individuals are involved in the use of any body of water to permit a simple choice. The Fish and Wildlife Service, the Public Health Department, the local water authority and certainly the agricultural user of the water are all concerned in the choice of treatments introduced into water systems. All these points of view, in turn, influence the development, formulation and manufacture of an aquatic herbicide.

Let's take a theoretical aquatic herbicide and look at the problems associated with it. The theoretical aquatic weed killing formulation should have the following characteristics:

1. Low level toxicity to human, animal, fish and fish food chain organisms.
2. Broad spectrum aquatic weed toxicity.
3. Rapid action on aquatic weed plants.
4. Short duration of residue in waters — yet long duration in bottom muds to prevent reinfestation.
5. High level tolerance by agricultural crops.
6. No lingering taste and odor.
7. Easy to apply — formulated to fit current and future equipment.
8. Economical for consumer.

I. LOW LEVEL TOXICITY

Compounds having high human toxicity will in the future have limited usage. Beside the inherent hazard, the need to develop qualified licensed operators and special equipment to handle dangerous chemicals adds greatly to the cost of weed control.

Toxic compounds must be removed rapidly from potable waters whether they be permanently fixed in the soil, volatilized out of the waters, hydrolyzed into inocuous metabolite or readily filtered out through the normal filtering systems.

Toxic compounds must be checked for short- and long-term effects on livestock and wild animals. The compound must not be stored in meat or milk. Extensive residue analysis work must be done to show no residue in any usable part of livestock. The use of toxic compounds which kill fish or affect any part of the fish food chain is limited to areas where fish utilization is of no importance.

II. BROAD SPECTRUM WEED CONTROL

The wide variety of aquatic weeds, coupled with a general lack of understanding of species differences, requires that a wide range of activity be built into an aquatic weedkiller formulation. The compound must not differentiate between a submersed, emersed or a marginal aquatic plant

It has been said that each pond is a separate entity in itself. This is another way of saying that local environmental conditions can and do affect the action of chemicals. One single compound cannot do this job. It seems only logical to think in terms of combinations of several compounds, each adding its own weedkilling properties to the total. All safe, effective and formulated for ease of use.

III. RAPID ACTION

For the individual financing, the weed control operation, there is great physiological value in a rapid-acting herbicide. Weedkillers that show definite effects soon after treatment have high consumer acceptance. Formulation can play a part in the rate of action. Surfactants added to contact herbicides to speed up action, high quality emulsifier systems which aid in thorough mixing or coverage, and spreader stickers which aid in coating the waxy water-repellent plant surfaces all are part of the development of this needed rapid action.

Further, desirable as rapid action is, it must be controlled to extent that it does not cause oxygen depletion and subsequent fish kills.

IV. RESIDUE

Short duration residual chemicals having a short term lethal contact time make the ideal herbicide. Those which are readily removed from the water or are easily deactivated have the greatest chance for success. Yet, paradoxically, compounds which provide long term control whether through retention on the soil or through controlled release formulations are most needed.

V. CROP TOLERANCE

Many of our aquatic problems occur in association with waters used for irrigation. Chemicals that are readily removed from the waters are safest, but those that are specific for aquatic species having little or no effects on terrestrial crop plants will have greater acceptance. The development of herbicides which can be used in an off season or draw down period have a wider range because several months may elapse between the time of application and the time the water is used.

VI. APPLICATION EASE

To a certain extent the development and widespread use of aquatic weed killers is dependent on ease of application. The commercial operator can improvise and make do, but the farm pond owner or lake association member needs effective simple do-it-yourself compounds.

It is in this area that the chemical manufacturer and his formulating chemist can be most helpful. He has two general categories in which to work — granular or liquid, but it is how he handles each one that makes the difference.

GRANULAR FORMULATIONS

The granulars in use today are 8-15 mesh or in the 15-30 range. There are reasons for one over the other, but the 8-15 because of its weight and size which aids sinking is preferred. The concentration of active ingredient is also important. Low concentration on clay granules adds considerable cost if high rates must be used. Concentration is a formulation variable dependent on rate and solubility. For plans of the future, the chemist will be thinking in terms of controlled release of single chemicals to maintain lethal contact time.

He must also be looking at combinations to be released at timed intervals in order to provide the needed broad spectrum weed control.

LIQUID FORMULATIONS

Liquid formulations have established minimum specifications. They must have good emulsifier systems to aid in the diffusion of the herbicide throughout the total water body. Adequate shelf life is also important, they must retain their efficiency when carried over into the next year's spray season. The formulation should wet well, having compatability with a range of surfactants. Finally, just as in terrestrial weed control work, the effective easy to apply liquid formulation must control drift and volatility when used in areas of sensitive crops or ornamentals.

EQUIPMENT FLEXIBILITY

The well formulated aquatic herbicide, whether liquid or granular, must be adequate for aerial, ground or mistblower application. For liquids, this means sprayability from 5 to 200 gallons per acre and with granular materials, uniform distribution at water level and at 50 to 60 feet above the water.

VII. ECONOMICAL IN COST

Within reason cost must be a limiting factor. In discussing formulations Dr. A. S. Crafts makes this statement: "Formulations are designed first to improve performance, and secondly to make for convenience in handling and application." When a manufacturer is forced to put out a cheap formulation to meet a price situation, that is exactly what is delivered. The extra efforts that go into quality formulations have to be left out. Weed control is what is being bought, not the cheapest chemical, and performance rather than price must eventually be considered the primary criterion of a good herbicide.

AMCHEM'S PROGRAM IN AQUATICS

Amchem has a past history of successful solutions for terrestrial weed control problems. This backlog of experience is being carried over into aquatic weed control. The knowledge and experience is shown in the development of improved formulations such as the original low volatile esters of 2,4-D and other phenoxy compounds. It is also expressed in the use of emulsifiable acids and invert formulations designed to control drift and volatility. At times formulation alone did not completely answer the problem and special equipment such as the centrifugal sprayer and granular applicator were developed to obtain maximum utilization of improved formulations.

The backbone of any herbicide development operation is a good screening program which can produce new compounds and improve old ones. Amchem has been able to utilize past knowledge gained from terrestrial screening in developing its aquatic program. At present we have a very effective 2.4-D formulation labelled for the control of several submerged and emerged weeds. We have an amitrole or amitrole-T for controlling cattails, phragmites, and water hyacinths, and we have just recently been given permission to label fenac as a soil-applied herbicide for hard-to-kill submersed weeds such as the Potamogeton species.

We have not resolved all aquatic weed problems, but we will continue to offer products which are as good as or better than any others available, and equipment for spraying or spreading them efficiently so their full potential can be realized.

Program Your Aquatic Weed Control Needs

By

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The title of this talk is PROGRAM YOUR AQUATIC WEED CONTROL NEEDS. What does it mean to program? Do we realize what the word program can imply? Webster defines program as a "plan of future procedures." An apt definition but one which does not completely describe all of the side effects of programming. Another definition listed for program is "a doctrine, theory or system whose validity can be tested only in practical application." This, perhaps, is even a better definition for us working in weed control. Basically, however, the word programming means "what are we trying to accomplish" and "how can we go about with the task at hand." One way to do this is to list what the problems might be in regard to the type of aquatic weed "problem" you have. "Problem" would include not only the species that are present, but which species you would like to have present, or perhaps what is the purpose of the weed control program, be it drainage ditch, irrigation canal, farm pond, water fowl refuge or what have you. Other points that need to be listed; what are the ramifications of your control program, is spray drift a problem, is it a water shed area, how about fish population, is the area used for swimming, irrigation or what else? One factor that must be considered is that you obviously cannot use a different material for each species present. Therefore, you must use a material which has a broad enough spectrum so that the primary weed populations will be removed. Perhaps the next year, then, the material will have to be changed to pick up the resistant weeds that were not killed by the first year's application. Another factor which may be important is ecology. After you spray one weed population, what changes can be expected in the population? And, of course, last but not least, are the economics involved. Of course, they are always important but sometimes these are relatively important, sometimes they are relatively unimportant when looking at the total program. In short, programming your aquatic weed control needs actually becomes very complicated when all factors of control are considered.

Let us examine some of these factors in detail so that we can arrive at principles where these factors might be taken into consideration in programming our control needs. Perhaps the most obvious place to start is which weeds do we have to control or which weeds are our problem. It is not necessary to go into any discussion on identification of the various aquatic weeds since these have been discussed in some detail before the society on several occasions. One point, however, that must be considered is the considerable variation in the time when the aquatic weeds are most susceptible to chemical treatment. For some species like the Arrowarum *(Peltandra spp.)* the most susceptible period is during the flowering stage. For other plants such as the rose mallows, hibiscus species and cattails (*Typha spp.*) the time of greatest susceptibility is during the late flowering and the early stages of seed production. Giantcutgrass can be killed most easily during the period of maximum runner growth, which usually