Control Of Hydrilla Using The Bifluid System

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INTRODUCTION

It is man's responsibility to correct and restore the environment in which we live. A new approach must be made to develop more effective, and less expensive, chemical control of submersed aquatic weeds. Concentration of some herbicides in large quantities will cause contact kill of the tissues and translocation is stopped. It is also known that if the herbicide concentration in the phloem is too high it will kill the living cells, thus stopping translocatingtion. (1) Some chemicals move with plant foods; therefore, if they are applied to the foliar or stem portion in a media to allow entry into the plant, they will move in the phloem unless movement is deterred.

CHARACTERISTICS

The Bifluid System is a scientifically and commercially accepted method for the preparation and application of water-in-oil (W/O) and oil-in-water-in-oil (O/W/O) emulsions (Figure 1). This system has worked well for the control of surface plants, both for ground and aerial application procedures. Water-in-oil emulsions characteristically have a thick, mayonnaise-like, consistency and appearance. This consistency, in part, accounts for the interest that was generated in the fall of 1970 to begin a series of test plots, using different formulations of herbicides in the system for control of hydrilla (*Hydrilla verticillata* (L.F.) Casp).

METHODS AND MATERIALS

An airboat, with rear mounted boom, was employed to apply the bifluid system. The herbicides were injected beneath the surface of the water using a 5 gal/min pump with a maximum pressure of 400 lbs. Nine drop lines, approximately 14 in. long equipped with Tee Jet spray nozzles (8006E) mesh screens, were installed on an 8 ft. boom mounted on the rear of the airboat A mixing valve known as a Bi-Vac unit was installed in the system which includes the necessary orifice plates to calibrate the proper ratio of the oil and water phases. The unit also employs a vacuum gage that insures the proper function of the system (Table 1).

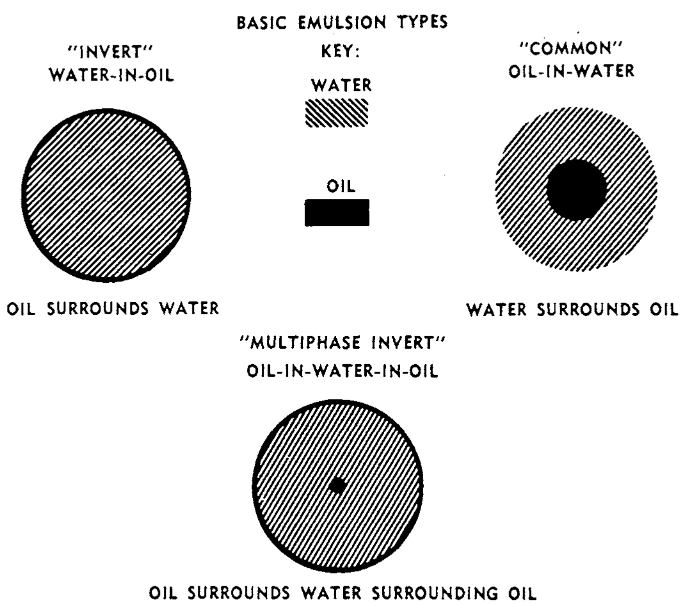

Figure 1.—Basic Emulsion Types Involved in the Bifluid System.

TABLE 1. SELECTION AND INSTALLATION OF METERING ORIFICES USED IN THE BIFLUID SYSTEM.

Description of Metering Orifices	Dimensions
Sprayer output	3.1 to 5.0 gal/min
Minimum size for water suction	¾ inch
Minimum size for oil suction	½ inch
Water orifice	0.25 inch inside diameter
Oil orifice for water:oil ratio[a]	
6:1	0.103 inch inside diameter
9:1	0.083 inch inside diameter
Vacuum gage read	8 to 25 inches mercury

[a]The water-to-oil ratios listed are approximate only. Variations on the order of 10% are considered normal and acceptable. With a given set of metering orifices, do not attempt to apply the emulsion at a discharge rate outside the range shown for those orifices. Operate the pumping unit at 125 P.S.I., which should give liquid pressure in P.S.I. at each nozzle tip of approximately 40 lbs.

It was observed early in this study that it would be necessary to select an acceptable oil or an oil-like substance that would penetrate the cuticle (or dissolve the wax coating that acts as a barrier), allowing the chemical in the water phase to be absorbed into the leaf cells. Oils cause burns, or kill the tissues, if used in too large amounts. Whale, peanut, diesel, and xylene oils have been used in the study, with xylene judged to be the most acceptable at this time. The oil phase of the system is not the prime carrier of the herbicide but only a tool to help place the chemical where it is wanted and keep it there. The first two items in each test plot, Table 2; make up the oil phase side of the system.

RESULTS

The Bifluid System allows any desired concentration of herbicides to be used in the water phase. Table 2 can be used as a guidline; however, the length of control time is not always conducive because of variance in water quality.

TABLE 2. USE OF VARIOUS CHEMICALS IN THE BIFLUID SYSTEM FOR THE CONTROL OF HYDRILLA.

Chemicals for 1.0 Surface Acre	Control in 7 days	Control Until Regrowth	Fish Toxicity
Test 1		months	
5 gal. Xylene 1 gal. D.P.N. (Adjuvant) (Amine Salts) 1 gal. 6,7-dihydradipyrido (1,2-a:2′, 1′-c) pyrazinediium 10n 20 lbs. Copper Sulphate pentahydrate ($CuSo_4 \cdot 5H_2O$)	20%[a]	10	None
Test 2			
5 gal. Xylene 1 gal. Amine Salts 2 gal. Diquat 2 gal. Copper Triethanolamine (Cutrine) 50 lbs. Ammate X	50%	3	None
Test 3			
5 gal. Xylene 1 gal. Amine Salts 2 gal. Diquat 4 gal. Cutrine 50 lbs. Ammate X	90%	5	Few small fish in heavy weed growth
Test 4			
5 gal. Xylene 1 gal. Amine Salts 2 gal. Diquat 3 gal. Cutrine 50 lbs. Ammate X	80%	5	None
Test 5			
5 gal. Xylene 1 gal. Amine Salts 4 lbs. Diuron (Karmex) 50 lbs. Ammate X	30%	2	None
Test 6			
5 gal. Xylene 1 gal. Amine Salts 1 gal. Mono (N,N-dimethylalkylamine) (Hydrothal 191) 50 lbs. Ammate X	5- %	2	None
Test 7			
5 gal. Xylene 1 gal. Amine Salts 3 gal. Dipotassium Salt of Endothall (Potassium Endothal) 50 lbs. Ammate X	80%	4 b	None

[a]0—no Control: 100—Complete Control.
[b]The field evaluation of this mixture is incomplete at this writing.

CONCLUSIONS

It was found, with the submersed plant species, that it was necessary to add weight to the water phase of the system to cause the 200 micron size droplets to sink and dissipate in heavy infestations of weeds. Ammonium Sulfamate (Ammate X) was selected at the rate of 1.0 lb/gal of water phase of the system. It is suggested that under certain conditions (flowing water or water in areas of heavy tide change), that the weight factor be increased to compensate for the rate of flow, plus a factor to consider the depth. This, of course, would vary and should be left to the judgement of the applicator for best results.

Apparently some growth stages of hydrilla are more susceptible to control by the system than others. It has been established that the system can and does work well during the dormant growth period with excellent control achieved during the winter months. In summary, the greatest conclusion that the Bifluid System has shown is the safety toward the aquatic fauna. Toxicity to fish is almost nonexistent; they remain in their natural environment, unconcerned by the application of the system (2). Hopefully, we can continue to have this kind of management for man's environment.

LITERATURE CITED

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2. Schneider, Robert and Rue Heston. 1970. Personal communications. Biologists, Game & Fresh Water Fish Commission.