Stull Bifluid Spray System

DAVID P. PETERSEN and ROBERT E. BURGDORFF

Stull Chemical Company
San Antonio, Texas

Each year, about this time, door to door peddlers drop by our homes selling large fruit juice cans containing beautiful, blooming water hyacinths, freshly picked from the scenic San Antonio River—six for a dollar. Based on our estimate of the supply situation, we could wipe out the nation's unemployment problems, beautify every American home, and increase consumption of Florida citrus tremendously with some promotional effort. But, this method of aquatic weed control is fraught with implications of anti-trust violations, congressional investigations and the like, so we shall confine our presentation to a more practical approach to aquatic weed control.

Fourteen years ago, we helped to pioneer a new concept of vegetation control on industrial rights-of-way, using helicopters as an application vehicle. Simultaneously, we began searching for improvements to the spray dispersal equipment and the herbicide formulations in order to reduce off the right-of-way damages and to increase vegetation control efficiency. From this effort evolved the Stull Bifluid System for the application of water-in-oil (or, invert) emulsions (Figure 1). Since the first commercial helicopter applications utilizing this system in 1959, there have been numerous improvements to both equipment and formulations. The system has been adapted to just about every type of power sprayer capable of applying most presently used weed control chemicals as "invert" emulsions. The principal improvement in formulations has been the development of the oil soluble amine salt formulations of phenoxy herbicides and of spray adjuvant formulations all capable of producing "invert" emulsions.

For water hyacinth control, invert emulsion applications of an oleyl amine salt of 2,4-D at the rate of 2 lbs, ae/A have given excellent results in numerous commercial applications since 1963. Applications by aircraft are normally made at a volume of 16 gallons of emulsion per acre. Portable power sprayers in boats will increase this total volume to approximately 40 gals/A to insure adequate coverage. Since our formulation of oleyl amine salt of 2.4-D, identified in the trade as INSTEMUL DA 120, is a concentrate containing 3 lbs. ae/gal, it must be premixed with diesel fuel at rates of 1:2 to 1:5 prior to mixing with water in bifluid equipment. The normal oil phase to water phase ratio for direct application to the hyacinths is 1:7 for aircraft, and 1:9 for portable sprayers.

Commercial applications to alligatorweed were begun in 1966 in East Texas, utilizing the same application rates and volumes as used for water hyacinths (Figures 2 and 4). Results of these applications have been very satisfactory as a maintenance practice on the particular canals involved (Figure 3). Further commercial applications are going on, now, in Texas, Louisiana and Florida, and final results are not available.

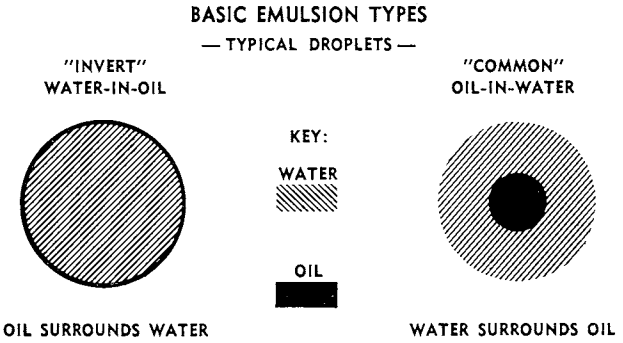
The capability of greater on-target accuracy with invert emulsions, coupled with their ability to float on the water surface are decided advantages to their use in emergent weed control. There is some evidence that the oil soluble amine salt form of 2,4-D has greater herbicidal activity in plants. Tests are currently being conducted in cooperation with Louisiana and Texas researchers to confirm this theory.

The excellent result of combination sprays of INSTEMUL DA 120 and monosodium methanarsenate (Ansar 170) on industrial rights-of-way, has encouraged us to try them on mixed vegetation in aquatic sites. There is evidence, here, of a synergistic influence of one compound on

THE STULL BIFLUID SYSTEM

GENERAL — The Stull Bifluid System is a scientifically and commercially accepted method for the preparation and dissemination of water-in-oil (invert) emulsions. The major advantages of the system are:

1. Maximum control of spray drift approaching virtual elimination.
2. Absolute accuracy in proportioning of the oil and water components of the emulsion through orifices of known diameter.
3. Maximum mixing of components on a continuous basis, instantaneously, during actual spraying operations, to produce an "invert" emulsion of absolute homogenious composition.
4. Maximum uniformity of droplet size over the entire effective spray swath.
5. Maximum conservation of spray components since all of the chemical reaches its intended target.
6. Maximum versatility since the system may be installed on any type of application vehicle (aerial or ground).



Both droplets contain one part of Oil to 10 parts of Water

PRINCIPLE OF OPERATION — The Stull Bifluid System is basically a process for the simultaneous proportioning, mixing and spraying of an oil-base pesticide chemical formulation and water. These components form an emulsion of water-in-oil, commonly referred to by agriculturists as an "invert" emulsion, rather than the "common" oil-in-water emulsion normally used in agriculture.

Water-in-oil emulsions characteristically have a thick "mayonnaise-like" consistency which in part accounts for their resistance to wind drift. In addition, the water part of the droplet is surrounded by an oil film which nearly eliminates the evaporation rate of droplets as they move through the air. Common oil-in-water emulsion droplets reduce in size rapidly as the outer water film evaporates. This resistance to evaporation by invert emulsions accounts for a part of the drift resistance and for the uniformity of spray pattern since the droplets remain essentially the same size from their point of discharge to their intended target.

Figure 1.

Figure 2. Alligatorweed infestation in a rice irrigation canal being treated by helicopter near Anahuac, Texas, in early March, 1967, with 2 lbs. 2,4-D ae/A as an oil soluble amine invert emulsion.

the other with relatively low rates of Ansar 170 in the invert emulsion. In these combinations, the Ansar 170 is premixed with the water phase to give an application of 2 to 3 pounds, active, per acre in combination with 2 pounds of 2,4-D.

Our last consideration of utilization of the bifluid system is the application of basically neutral spray adjuvants, or emulsifier systems, which produce water-in-oil (invert)

Figure 3. Same irrigation canal in early June shows very little spotty regrowth along bank edges.

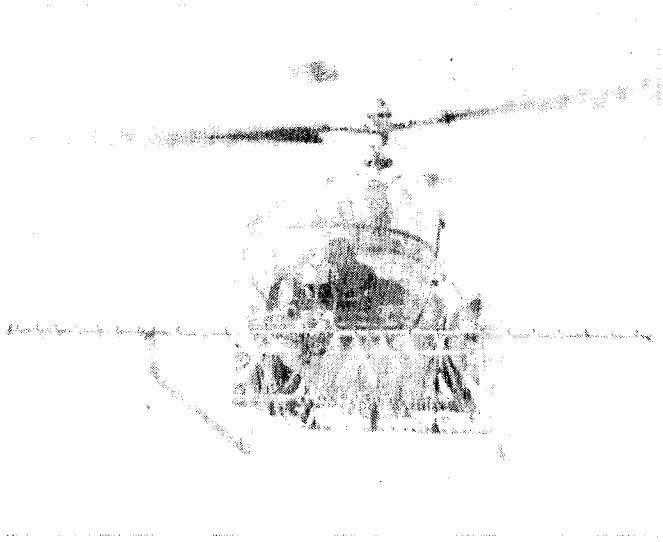


Figure 4. Heavy invert spray droplets look similar to strings of spagetti as they leave spray tips designed for drift control applications.

emulsions in combination with a wide range of herbicides. A number of recent applications have been made in aquatics with water-in-oil emulsions of ammonium sulfamate (Ammate X) which incorporate one of our adjuvants, BIVERT-AMX. These applications show promise on weed and brush growth on canal slopes, where the use of phenoxy herbicides is precluded for safety considerations, as well as on some submerged aquatic species. One unique feature of invert emulsions of Ammate is the users ability to control the specific gravity of the emulsion droplets. In concentrations of one or more pounds per gallon, emulsion droplets will sink and attach themselves to submersed weeds. We are testing two techniques: surface coverage with subsequent sinking and underwater dispersion. No conclusive recommendations are available at this time as to which method is preferred for various growth conditions.

We have presented in general terms the commercial utilization of the Stull Bifluid System as an aquatic weed control technique. Certain of its aquatic uses are well established over several years usage. Other, newer, uses are currently under investigation. Because of the ease with which it may now be adapted to any sprayer, the bifluid system offers new safety as well as new dimensions to aquatic weed control.