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AQUATIC HERBICIDE DATA

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Agriculture Handbook No. 231

Agricultural Research Service
UNITED STATES DEPARTMENT OF AGRICULTURE

AQUATIC HERBICIDE DATA

Compiled by

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This study was carried out at the Agricultural Experiment Station, Auburn University, under contract with the Agricultural Research Service, United States Department of Agriculture.

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AQUATIC HERBICIDE DATA

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Problems in the Control of Aquatic Weeds

Aquatic plants growing within or at the water's edge of ponds, lakes, streams, drainage ditches, and irrigation channels cause many problems in the management and utilization of these waters by man. The principal water uses at present include fish production, domestic and industrial water supplies, irrigation, stock watering, waterfowl habitat, and recreation. Obnoxious aquatic growths common to various waters that interfere with one or more of the uses come from the following groups: plankton algae, filamentous algae, submerged rooted plants, emergent rooted plants, marginal rooted plants, and floating types of plants.

Many species of plankton algae are beneficial and essential in that they provide the basic food for fish production. However, these same species of algae are undesirable in domestic water supplies since they impart odors and flavors to drinking waters and for industrial uses as they produce sludge, foam, and scale. A mixed growth of algae and fungi on domestic and industrial cooling towers renders their operation difficult and inefficient. The recreational value of ponds and lakes can be greatly reduced by scums and odors produced by certain blue-green algae.

The filamentous algae serve practically no useful purpose beyond their occasional use for controlling submerged rooted vegetation in ponds and lakes. In fisheries filamentous algae usually reduce fish production, provide too much cover for small fish, and interfere with the harvesting of fish by draining, seining, or fishing. In practically all other water uses these algae impede flow, cause clogging of pipes and filters, and provide breeding places for mosquitoes.

The submerged rooted plants and the emergent rooted plants in fish ponds decrease fish production, promote overcrowding of population with small fish, and interfere with harvesting of fish. These plants fill up the pond, stream, or channel; obstruct the flow; and eventually reduce the volume. This condition usually makes the body of water undesirable for any use except for a waterfowl habitat. The seed heads and other plants parts of a few plants in these two groups—submerged and emergent plants—provide desirable waterfowl food, but the majority of both groups usually are classed as "weeds." Some in both groups of plants offer habitats for the production of mosquitoes and possibly provide a breeding habitat for snails, which are vectors of many parasites of fish, birds, and mammals.

The marginal rooted plants usually are considered unsightly along bodies of water. However, these plants are undesirable chiefly because they invade the water's edge and eventually fill in the pond, lake, stream, or canal and reduce its volume. In small streams and especially in canals they seriously impede the flow of water. Most of these plants also provide breeding habitats for mosquitoes and snails and offer hiding places for snakes. A few plants in this group are valuable as food for waterfowls or other wildlife.

The floating types of plants have no useful purpose in any of the water uses previously mentioned. They decrease fish production, contribute to overcrowding of fish population, and seriously interfere with harvesting of the fish. These plants clog streams and channels and impede or block their flow; they also fill in the areas when they die and decay. Most of these plants also provide breeding habitats for mosquitoes and snails. Water-hyacinths, however, tend to inhibit the breeding of the *Anopholene* mosquitoes.

These problems arising from the presence of aquatic plants have increased manyfold in the 20th century because of the expanded development and utilization of manmade ponds, lakes, and irrigation channels. At present the utilization of existing surface water supplies is proceeding at a record-breaking rate. Developing along with this accelerated utilization of surface water supplies has been the ever-increasing problem of control of the aquatic plant growths within them. Before World War II chemical control of aquatic weeds was limited to the use of copper sulfate for killing algae and sodium arsenite for killing all types of aquatic plants. Since 1946 the use of chemicals for controlling all types of aquatic plant growths has been greatly expanded. The information on such research and results of field trials is widely scattered in various publications and is not readily available to the technician in the field. This handbook was compiled to bring this information together and to summarize it.

Methods of Presentation of Data

The data reported in this handbook were obtained from information sources available to the compiler. All the world literature on this subject was not reviewed.

The compiler has made no attempt to place any evaluation on the results beyond that reported by the respective authors. The results are expressed in the author's terms as nearly as possible.

The scientific names of higher plants are those in established usage by the Department of Agriculture. Where the name in any reference differs from this, the name used in the reference is in parentheses following the approved name. In the few instances where the name in the references could not be identified by the Department or is not used for the common name given, the name is placed in parentheses. The names of chemicals are those used by the Weed Society of America.

The first section of this handbook is a listing of the chemicals for which data are available. Next is a plant index, which includes listings of all genera and species of algae and of all genera and species of higher plants on which screening tests and field chemical-control data has been recorded. The listing of higher plants is divided into groups of submerged, emergent, marginal, floating, and miscellaneous weeds.

Table 1 presents data on the toxicity to fish and other aquatic animals of chemicals that have been used as aquatic algacides or herbicides. These data are tabulated as completely as possible, and a reference to the original source is given. There are numerous inconsistencies among the various references to various chemicals. Since no attempt has been made by the compiler to evaluate this information, any investigator using such chemicals for weed control in waters inhabited by fish should determine the toxic level of a chemical under his own conditions before proceeding with a large-scale program of weed control. Many local factors, such as water temperature, total hardness, and turbidity, affect or alter the toxicity of a given chemical to fish and other animals in certain waters. These toxicity data (often determined under laboratory conditions) serve only as a guide for more accurate determinations of local tolerances.

Tables 2 to 8 present data on effects of copper sulfate on aquatic organisms, effects of aquatic herbicides on plankton algae, and several groupings of effects of aquatic herbicides or chemicals on algae.

Tables 9 to 13 present data on the effects of aquatic herbicides on aquatic plants. In this tabulation the plants are divided into the major groups mentioned earlier. For each species of plant, the common and the scientific names are given. In some instances, only the generic name is given since the exact species is unknown.

For each plant, under the heading "Herbicide" the official names of chemicals that have been used for its control are listed. The first item listed for each chemical is the concentration—either in parts per million or in percent—of active ingredient used if the entire volume of water was treated or the rate per acre of active ingredient of the chemical. The next item listed is the carrier (water, oil, dust, or none), and, when available, the amount of carrier applied per acre (this often includes the total volume of both carrier and chemical).

The results with each chemical tested on each species of plant are given under "control," and, where possible, are stated as percent killed or percent controlled. In many cases the kill was not given in percent; rather it was expressed as poor, fair, etc. Although this column is headed "Control," usually the results reported are believed to represent temporary control for a few weeks, months, or a season at most rather than permanent control.

The column under "Remarks" contains information concerning date of treatment, method of application, habitat conditions, geographic location, and any other special information. These remarks are brief; if further information is desired, it may be obtained from the original reference.

Following the above-mentioned data on each chemical is a reference or references to the original publication or source of information.

The last section of the handbook is the bibliography in two parts. The first part contains references on the toxicity of aquatic herbicides and related compounds to fish and other aquatic animals. The second part contains references on chemical control of aquatic weeds.

Common Names or Designations for Chemicals Reported

Common name or designation	*Chemical name*
Acriflavin	2,8 diamino-10-methylacriduim chloride
Acrolein	acrylaldehyde
Alum	aluminum potassium sulfate
Amitrole	3-amino-1,2,4-triazole
AMS	ammonium sulfamate
Amsco HT solvent	mineral spirits (aromatic solvent)
Aromatic Esso WS–1492.	Do.
Aromatic Esso WS–1494.	Do.
Aromatic Esso WS–1495.	Do.
Atabrine	quinacrine hydrochloride
Atlacide	sodium chlorate
Atrazine	2-chloro-4-ethylamine-6-isopropylamino-s-triazine
BHC	benzenehexachloride
Borascu	anhydrous metaborate
CDEA	2-chloro-N,N-diethylacetamide
CIPA	isopropyl N-(3-chlorophenyl) carbamate
Chloroben	chlorinated benzene
$CuSO_4$	copper sulfate
$CuCl_2$	cuperic chloride
2,4-D	2,4-dichlorophenoxyacetic acid
BE	butyl ester
BEE	butoxy ethanol ester
DMS	dimethylamine salt
EE	ethyl ester
IOE	isooctyl ester
IPE	isopropyl ester
L.V. ester	low volatile ester
ME	methyl ester
Na salt	sodium salt
NH_4 salt	ammonium salt
PGBEE	propylene glycol butyl ether ester
TBP	tributyl phosphate
TEA	triethanolamine
DAC	dodecylacetamide dimethylbenzyl ammonium chloride.
Dalapon	2,2-dichloropropionic acid
DB	metaborate+2,4-D
4-(2,4-DB)	4-(2,4-dichlorophenoxy) butyric acid
DMS	dimethylamine salt
DCB	orthodichlorobenzene
Delrad	dehydroabietylamine acetate
Delrad 50	
Delrad 50S	
Delrad 70	
2,4-DEP	tris(2,4-dichlorophenoxyethyl) phosphite.
Dichlone	2,3-dichloro-1,4-naphthoquinone
Diquat	1:1′-ethylene-2:2′-dipyridylium dibromide.
Diuron	3-(3,4-dichlorophenoxy)-1,1-dimethylurea.
DNBP	4,6-dinitro-0-secondary butylphenol
DNC	3,5-dinitro-0-cresol
DNCHP	2,4-dinitro-6-cyclohexyl phenol
2,3-DNQ	2,3-dichloronaphthoquinone
Dowpon	2,2-dichloropropionic acid
Emul WS–1492	mineral spirits (aromatic solvent)
Endothal	3,6-endoxo hexohydrophthalic acid
Frbon	2-(2,4,5-trichlorophenoxy)ethyl 2,2-dichloropropinate
Esteron	2,4-5-trichlorophenoxyacetic acid, propylene gycol buytol ether ester
Fenac	2,3,6-trichlorophenylacetic acid
Fenuron	3-(p-chlorophenyl)-1,1-dimethylurea
Ferbam	ferric dimethyl dithiocarbamate
Fermate	ferric dimethyl dithiocarbamate
HCA	hexachloroacetone
HT solvent	mineral spirits
Hyamine 1622	para diisobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride
Hyamine 2389	alkyl (C_9–C_{15}) totyl methyl trimethyl ammonium chloride
IPC	isopropyl N-phenylcarbamate
$KMnO_4$	potassium permanganate
MCPA	2-methyl-4-chlorophenoxyacetic acid
4-(MCPB)	4-(2-methyl-4-chlorophenoxy) butyric acid
MH	maleic hydrazide
Monsanto PCB	paradichlorobenzene
Monuron	3-(p-chlorophenyl)-1,1-dimethylurea
Movidyne	colloidal silver
Na PCP	sodium pentachlorophenol
Na TCA	trichloroacetic acid, sodium salt
Neburon	1-n-butyl-3-(3,4-dichlorophenyl)-1-methylurea
Nigrosine dye	
Oktone	octachlorocyclohexenone
PBA dimethyl amine	polychlorobenzoic acid
PCB	polychlorobenzene
PCP	pentachlorophenol
PMA	pyridylmercuric acetate
Phygon XL	2,3-dichloronaphthaquinone
RADA	dehydroabietylamine acetate
RADS	dehydroabietylamine sulfate
Roccal	alkyl-dimethyl-benzyl-ammonium chloride
Silvex	2-(2,4,5-trichlorophenoxy) propionic acid
IOE	isooctyl ester
Na salt	sodium salt
PGBEE	propylene glycol butyl ether ester
TBP	tributyl phosphate
TEA	trithanolamine
Simazine	2 chloro-4,6-bis (ethylamino)-s-triazine
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
DMS	dimethylamine salt
IPE	isopropyl ester
TBP	tributyl phosphate
TEA	triethanolamino
TBA	
2,3,5-TBA	2,3,5-trichlorobenzoic acid
2,3,6-TBA, sodium salt	2,3,6-trichlorobenzoic acid
TCA	trichloroacetic acid
2,4,5-TCB	2,4,5-trichlorobenzene
TCE	trichloroethylene
Ureabor	diruon+sodium borate
Ziram (ZDD)	zinc dimethyl dithiocarbamate

Names of Algae and Aquatic Plants Studied

Algae Used in Algacide Tests

Algae	*References*
Achnanthes linearis	[1](*173*)
Anabaena	(*128, 134, 146, 177, 205, 238, 244*)
Ankistrodesmus falcatus	(*173, 205, 244*)
Aphanizomenon	(*134, 146, 177, 199, 205, 244*)
Asterionella	(*146, 177, 205, 244*)
Calothrix braunii	(*173*)
C. parietina	(*134*)
Ceratium	(*146*)
Chara	[2](*97, 133, 135, 146, 169, 171, 191, 198, 206, 211, 230, 234, 235, 238, 239, 244*)
Chlamydomonas	(*134, 146, 177, 205*)
C. communis	(*173*)
C. paradoxa	(*173*)
Chlorella	(*134, 135*)
C. variegata	(*173, 187*)
Chlorococcum botryoides	(*173*)
C. humicola	(*173*)
Chroococcus	(*176*)
Cladophora	(*102, 133, 135, 14 177, 181, 205, 23 234, 238, 244*)
Clathrocystis	(*146, 244*)
Closterium	(*146, 177, 244*)
Coccochloris peniocystis	(*134*)
Coccomyxa simplex	(*173*)
Coelastrum	(*146, 173, 244*)
Coelosphaerium	(*146, 177, 205, 244*)
Compsopogon	([3])
Conferva	(*146, 238*)
Cryptomonas	(*146*)
Cyclotella	(*146*)
Cylindrospermum	(*146, 173, 187*)
Desmidium	(*146, 177, 244*)
Dictyosphaerium	(*146*)
Dinobryon	(*146*)
Draparnaldia	(*146, 177, 244*)
Enteromorpha	(*146, 244*)
Eudorina	(*146, 177, 244*)
Euglena	(*146, 177*)
Fragilaria	(*128, 146, 177, 205, 244*)
Glenodinium	(*146*)
Gloeocapsa	(*146*)
G. alpicola	(*134*)
G. dimidiata	(*134*)
G. membranina	(*134*)
Gloeocystis	(*146, 173*)
Gloeotrichia echinulata	(*134*)
Gomphonema parvulum	(*173, 187*)
Hydrodictyon	[2](*128, 133, 146, 177 182, 183, 184, 205, 209, 211, 230, 244*)
Lyngbya	(*128, 134*)
Mallomonas	(*146*)
Melosira	(*146, 244*)
Mesotaenium caldoriorum	(*173*)
Microcystis aeruginosa	(*134, 173, 187*)
M. incerta	(*128, 134, 146, 177, 244*)
M. marina (*Anacystis marine*)	(*134*)
Microspora	(*146, 244*)
Navicula	(*146, 238, 244*)
Nitella	(*146, 177*)
Nitzschia	(*146*)
N. palea	(*173, 187*)
Nostoc commune	(*134*)
N. muscorum	(*134, 173*)
Oedogonium	[2] (*97, 230, 234*)
Oocystis lacustris	(*173*)
O. marsonii	(*173*)
Oscillatoria	(*97, 135, 146, 177, 205, 238, 244*)
Palmella	(*146, 244*)
Pandorina	(*128, 146, 177, 244*)
Pediastrum	(*128*)
Peridinium	(*146, 177*)
Phormidium	(*135, 173*)
Pithophora	[2] (*135, 184, 209*)
Plectonema nostocorum	(*134, 173*)
Porphyridium	(*97*)
Protococcus	(*146, 176*)
Raphidium	(*146*)
Rhizoclonium	([2])
Scenedesmus	(*134, 146, 173, 177, 205, 238, 244*)
S. obliquus	(*173, 187*)
Sphaerella lacustris	(*173*)
Spirogyra	[2] [3] (*97, 110, 133, 135, 146, 176, 177, 181, 182, 205, 206, 230, 238, 244*)
S. dubia	(*176*)
S. nitida	(*176*)
Staurastrum	(*128, 146, 205, 244*)
Stephanodiscus	(*146, 244*)
Stichococcus	(*134*)
Stigeoclonium	(*134, 176*)
S. nanum	(*173*)
Symploca erecta	(*173*)
Synedra	(*146, 177, 205, 244*)
Synura	(*146, 177*)
Tabellaria	(*146, 177, 244*)
Tetrastrum	(*146*)
Tribonema	(*244*)
T. utriculata	(*97*)
Ulothrix	[3] (*146, 238, 244*)
Uroglena	(*146, 177*)
Volvox	(*146, 177, 238, 244, 245*)
Zygnema	[2] (*97, 133, 146, 177, 205, 206, 244*)

[1] Italic numbers in parentheses refer to Selected Bibliography, p. 126.
[2] AUBURN UNIVERSITY. DATA ON CHEMICAL WEED CONTROL IN PONDS. Ala. Agr. Expt. Sta., Farm Ponds Proj. Unpublished Ann. Rpts. 1946-61.
[3] Personal correspondence on the use of RADA from R. F. Blanks, Bur. Reclam., Denver. 1950.

Aquatic Plants Used in Herbicide Tests

Aquatic plants	*References*
Submerged weeds:	
Cabomba caroliniana—Fanwort	[1] (*97, 123, 159, 160, 169, 197, 236, 251*)
Callitriche spp.—Water-starworts	(*109*)
Ceratophyllum demersum—Coontail	[1] (*97, 109, 110, 123, 141, 144, 148, 149, 159, 160, 169, 188, 198, 201, 211, 227, 229, 239, 247*)
Eleocharis acicularis—Needlerush	[1] (*159, 210, 211, 235, 236*)
E. cellulosa—Needlerush	(*211*)
E. parvula—Spikerush	(*211*)
Elodea canadensis (*Anarcharis canadensis*)—Elodea	[1] (*97, 102, 109, 110, 117, 123, 125, 148, 159, 160, 167, 171, 185, 188, 197, 198, 227, 230, 232, 234, 236, 239, 246, 251, 252*)
E. densa (*Anacharis densa*)—Dense waterweed	(*108, 109, 150, 159, 171, 181*)
E. occidentalis (*Anacharis occidentalis*)—Western waterweed	(*125, 180, 181, 239*)
Heteranthera dubia—Water-stargrass	[1] (*97, 117, 180, 181, 188, 211, 227, 229, 232, 239, 247, 252*)
Hydrochloa caroliniensis—Southern watergrass	[1] (*211, 235, 236*)
Hypericum spp.—St.-Johns-worts	(*101, 240*)
Juncus spp.—Rushes	(*206*)
J. roemerianus—Needlerush	(*97, 98, 101, 174, 178, 211, 224, 226, 240*)
Jussiaea diffusa—Waterprimrose	(*147*)
J. peruviana—Waterprimrose	(*211*)
J. repens—Waterprimrose	(*211*)
J. uruguayensis—Waterprimrose	[1] [2] (*101, 103, 104, 151, 175, 200*)
Myriophyllum spp.—Watermilfoils	(*123, 135, 148*)
M. brasiliense—Parrotsfeather	[1] (*119, 125, 180, 181, 211, 232, 235, 236, 239*)
M. exalbescens—Watermilfoil	(*97, 119, 125, 144, 160, 169, 224*)
M. heterophyllum—Milfoil	[3] (*126, 131, 144, 182, 188, 197, 232, 235, 236, 251, 252*)
M. verticillatum—Milfoil	(*199*)
Najas spp.—Naiads	[1] [2] (*107, 121, 149, 159, 188, 197, 201, 204, 209, 211, 220, 231, 232, 235, 236, 239, 246*)
Potamogeton spp.—Pondweeds	[1] [2] (*97, 104, 109, 123, 125, 131, 135, 141, 146, 158, 160, 169, 180, 201, 206, 209, 211, 227, 235, 236, 239, 246, 251, 252*)
P. amplifolius—Pondweed	(*191, 197*)
P. compressus—Pondweed	(*230*)
P. crispus—Crinkled-leaf pondweed	(*159, 160, 188, 191, 192, 230, 232, 234, 252*)
P. diversifolius—Pondweed	[1] (*103*)
P. epihydrus—Pondweed	(*102, 117, 180, 181, 188, 232*)
P. filiformis (*P. interior*)—Fine-leaf pondweed	(*98, 230, 232, 234*)
P. foliosus—Leafy pondweed	(*102, 117, 180, 181, 188, 227, 230, 232, 234, 247, 248*)
P. natans—Pondweed	(*159, 160, 191, 192*)
P. nodosus (P. *americanus*)—American pondweed	(*103, 117, 180, 181, 188, 230, 231, 232*)
P. pectinatus (*P. pectinatus* var. *interruptus*)—Sago pondweed).	(*102, 117, 125, 135, 159, 180, 181, 230, 239*)
P. pusillus—Pondweed	(*159, 160*)
P. richardsonii—Richardson's pondweed	(*117, 159, 180, 181, 239*)
P. robbinsii—Pondweed	(*159, 191, 192*)
P. spirillus—Pondweed	([1])
P. vaseyi—Pondweed	(*160*)
Utricularia spp.—Bladderworts	[1] (*97, 123, 191, 192, 211, 224, 232, 235, 236, 246, 251*)
Vallisneria americana—Eelgrass	(*97, 123, 159, 168, 252*)
Zannichellia palustris—Horned pondweed	(*117, 125, 180, 181, 188, 239*)
Emergent weeds:	
Brasenia schreberi—Watershield	[1] (*97, 101, 123, 159, 170, 192, 210, 211, 224, 225, 235, 236, 246*)
Ludwigia palustris—Waterpurslane	(*109, 232*)
Nasturtium officinale—Watercress	(*124, 180, 181, 232*)
Nuphar advena—Spatterdock	(*97, 99, 103, 121, 123, 148, 149, 159, 174, 191, 198, 211, 215, 224, 231, 232*)
Nymphaea spp.—Waterlilies	(*118, 119, 122, 123, 169, 170, 191, 192, 197, 206, 210, 232, 246, 251*)
N. mexicana—White waterlily	[1] (*149, 174, 210, 230, 231*)
N. odorata—White waterlily	[1] (*97, 101, 149, 174, 189, 210, 211, 223, 224, 230, 231, 235, 236, 240, 241, 242, 252*)
N. tuberosa—White waterlily	(*149, 174, 210, 230, 231*)
Oenanthe sp.—Waterparsley	(*109*)
Peltandra virginica—Arrow-arum	(*101, 149*)
Pistia stratiotes—Waterlettuce	(*121, 211*)
Ranunculus aquatilis—White watercrowfoot	(*109, 117, 232*)
Rorippa sp. (Israel)	(*109*)
Trapa natans—Waterchestnut	(*97, 141, 142, 174, 207, 232*)

See footnotes at end of list, p. 7.

Aquatic plants	*References*
Marginal weeds:	
Acorus calamus—Sweetflag	(*149*)
Aeschynomene virginica—Curly indigo	(*200*)
Alnus rugosa—Alders	(*174*)
A. serrulata—Alders	(*174*)
Alternanthera philoxeroides—Alligatorweed	(*101, 115, 116, 121, 122, 155, 156, 174, 197, 211, 224, 232, 240, 241, 242*)
Caperonia castaneifolia—Mexican-weed	(*200*)
Carex atherodes—Oregon sugargrass	(*180*)
C. aquatilis—Ripgutgrass	(*180, 181*)
Cephalanthus occidentalis—Buttonbush	(*101, 147, 174, 232*)
Cyperus acuminatus—Sedge	[1] (*103, 109, 210*)
C. articulatus—Yellow sedge	(*200*)
C. erythrorhizos—Sedge	[1] (*210*)
C. giganteus—Egyptian paperplant	(*224*)
(*Decodon americana*)—Waterwillow	(*103, 104, 149, 175*)
D. verticillatus—Waterwillow	(*159*)
Distichlis spp.—Saltgrasses	(*178*)
Eleocharis obtusa—Spikerush	[1] (*210, 231, 236*)
E. quadrangulata—Square-stem spikerush	(*232*)
Equisetum sp.—Horsetail	(*109*)
Glyceria sp.—Mannagrass	(*109, 235, 236*)
Hibiscus militaris—Rosemallow	(*149, 174*)
H. moscheutos—Rosemallow	(*149. 174*)
Hydrocotyle umbellata—Pennywort	[1] (*115*)
Juncus spp.—Tussock or rushes	(*109*)
J. effusus—Soft rush	[2] (*206, 210, 211, 232, 236*)
Justicia americana—Dianthera	(*147, 211*)
Leersia sp.—Cutgrass	(*235*)
Myrica cerifera (*Cerothamus ceriferus*)—Waxmyrtle	(*241*)
Nelumbo lutea (*N. pentapetula*)—Lotus	(*97, 98, 99, 101, 103, 104, 147, 149, 174, 211, 215, 232, 240*)
Orontium aquatium—Goldenclub	(*224*)
Panicum hemitomon—Maidencane	(*99, 101, 121, 174, 201, 211, 224, 241, 242*)
P. purpurascens (*P. barbinode*)—Paragrass	(*130, 196, 211, 212, 213, 220*)
P. repens—Panicum	(*101, 224, 241*)
Paspalum distichum—Knotgrass	[1] (*109, 210, 236*)
Phragmites communis—Phragmites	(*101, 126, 174, 201, 211, 212, 217, 240*)
P. maximus—Reedgrass	(*97, 210*)
Polygonum spp.—Smartweeds	[1] [2] (*98, 101, 115, 147, 210, 232*)
P. hydropiperoides—Waterpepper	(*159*)
Pontederia cordata—Pickerelweed	[1] (*99, 101, 104, 118, 121, 148, 159, 206, 224, 246*)
(*Ranunculus* sp.)—Marshmarigold	(*159*)
Sagittaria subulata—Arrowhead	[1] (*97, 103, 104, 123, 141, 147, 148, 149, 159, 175, 200, 232*)
Salix spp.—Willows	[2] (*101, 109, 239, 240, 241*)
S. alba—White willow	(*101, 240, 241*)
S. amygdaloides—Willow	(*101, 240, 241*)
S. caroliniana—Willow	(*101, 240, 241*)
S. cordata—Willow	(*101, 240, 241*)
S. discolor—Willow	(*101, 240, 241*)
S. exigua—Willow	(*101, 240, 241*)
S. interior (*S. longifolia*)—Willow	(*101, 240, 241*)
S. lucida—Willow	(*101, 240, 241*)
S. lutea—Willow	(*101, 240, 241*)
S. nigra—Willow	[1] (*101, 103, 147, 174, 175, 215, 232, 240*)
Saururus cernuus—Lizardtail	(*147, 210, 231*)
Scirpus spp.—Bulrushes	[2] (*101, 118, 206, 240, 252*)
S. californicus—Saltgrass	(*224*)
S. rubricosus (*S. eriophorum*)—Woolgrass	(*147, 210*)
S. validus—Soft-stem bulrush	[1] (*113, 122, 149, 170, 175, 230, 231, 232*)
Sesbania macrocarpa—Indigoweed	(*200*)
Sparganium sp.—Burreed	(*97*)
S. americanum—Burreed	(*109, 149, 201, 230, 232*)
S. angustifolium—Burreed	(*159*)
S. eurycarpum—Burreed	(*110, 150, 202, 231, 233*)
Spartina bakeri—Baker's cordgrass	(*224, 241*)
S. cynosuroides—Cordgrass	(*101, 242*)
S. patens—Saltmeadow cordgrass	(*240, 241, 242*)
S. spartinae—Cordgrass	(*210, 250*)
S. X *townsendii*—Cordgrass	(*194*)
Sphenoclea zeylanica—Gooseweed	(*200*)

See footnotes at end of list, p. 7.

Aquatic plants	*References*
Marginal weeds:—Continued	
Tamarix gallica—Saltcedar	(*239*)
Typha spp.—Cattails	[2] (*97, 99, 121, 148, 211, 240, 241, 242*)
T. angustifolia—Cattail	(*98, 99, 157, 158, 180, 181, 211, 240*)
T. domingensis—Cattail	(*98, 99, 101, 174, 224, 240, 241*)
T. glauca—Cattail	(*240*)
T. latifolia—Cattail	[1] (*91, 93, 94, 95, 96, 98, 101, 103, 104, 109, 113, 122, 127, 132, 136, 145, 147, 149, 152, 159, 169, 174, 175, 180, 181, 197, 201, 210, 212, 230, 232, 234, 236, 240, 252*)
Veronica spp.—Speedwells	(*109*)
Zizaniopsis miliacea—Giant cutgrass	(*97, 98, 99, 101, 140, 147, 195, 215, 224, 232, 240, 241*)
Floating weeds:	
Eichhornia crassipes—Water-hyacinth	[1] (*115, 153, 155, 156, 167, 169, 180, 181, 200, 211, 221, 232*)
Lemna spp.—Duckweeds	[1] (*103, 104, 110, 124, 133, 170, 175, 232, 235, 251*)
L. minor—Duckweed	[1] (*97, 198, 211, 236, 252*)
Salvinia rotundifolia—Waterfern	(*211*)
Spirodela polyrhiza—Big duckweed	[1] (*103, 104, 114, 124, 133, 170, 175, 232, 235, 251*)
Wolffia spp.—Watermeals	[1] (*103, 104, 114, 124, 133, 170, 175, 232, 236, 251*)
Miscellaneous weeds:	
Conyza spp. (Israel)	(*201*)
Inula sp. (Israel)	(*201*)
Rubus spp	(*201*)

[1] AUBURN UNIVERSITY. DATA ON CHEMICAL WEED CONTROL IN PONDS. Ala. Agr. Expt. Sta., Farm Ponds Proj., Unpublished Ann. Rpts. 1946–61.
[2] Personal correspondence from T. W. Wright. 1958.
[3] Personal communication from C. W. Wilde, Board of Fisheries and Game, Conn. 1957.

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TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Spartina patens (Saltmeadow cordgrass)—Continued						
Amitrole		5 lb. (each)		None	Treated June 25, and July 16, checked Oct. 1958.	(*242*)
		3 lb. (each)		do	do	(*242*)
		5 lb. (each)		50–60 percent	Treated June 25, July 16, and July 29, checked in Oct. 1958.	(*242*)
		3 lb. (each)		40 percent	do	(*242*)
		1 lb. (each)		10 percent	do	(*242*)
		3 lb		None	Treated June 25, checked in Oct. 1958.	(*242*)
		5 lb		40 percent	do	(*242*)
		20 lb		None	do	(*242*)
		1 lb		do	Treated June 25, checked in Oct. 1958, 400 sq. ft., plots in refuge.	(*242*)
		1 lb. (each)		do	Treated June 25 and July 16, checked in Oct. 1958, 400 sq. ft., plots in refuge.	(*242*)
Amitrole+dalapon		10 lb.+10 lb		80 percent	Treated June 25, checked in Oct. 1958, 400 sq. ft. plot, refuge.	(*242*)
		5 lb.+10 lb		60 percent	do	(*242*)
		3 lb.+10 lb		do	do	(*242*)
		2 lb.+3 lb		55 percent	do	(*242*)
		1.5 lb.+2 lb		40 percent	do	(*242*)
		10 lb.+3 lb		50 percent	do	(*242*)
		5 lb.+5 lb		60 percent	do	(*242*)
Spartina spartinae (Cordgrass)						
2,4-D, PGBEE		4.8 lb	Diesel fuel	90–100 percent	Pond tests	(*210*)
2,4-D, IPE		4–8 lb	do	do	do	(*210*)
Silvex		10.4 lb		88 percent	do	(*210*)
		83.2 lb		80 percent	do	(*210*)
TCA+silvex		10 lb.+20.8 lb	Water	98 percent	Pond tests	(*210*)
Dalapon		10 lb	do	Partial	do	(*210*)
Monuron		12–15 lb	do	Very effective		(*250*)
Amitrole		20 lb	do		Ponds; recommended rate	(*210*)
Amitrole+erbon		3.4 lb.+20.8 lb	do	96 percent	Pond tests	(*210*)
Erbon		10.4 lb	Diesel fuel	90 percent	do	(*210*)

Spartina × *townsendii* (Cordgrass)

Dalapon	----------	20 lb	Water, 100 gal	76 percent; complete recovery in 2 years.	11 months, England	(*194*)
	----------	30 lb	do	48 percent; complete recovery in 2 years.	do	(*194*)
	----------	40 lb	do	84 percent; complete recovery in 2 years.	do	(*194*)
	----------	50 lb	do	do	do	(*194*)
Fenuron	----------	40 lb	Water, 100 gal	92 percent	3.5 months, England	(*194*)
	----------	60 lb	do	96 percent; 99-percent kill.	15 months, England	(*194*)
Fenuron+2,4-D+sodium borate.	----------	15 lb. (fenuron)	Granules	65 percent	1 year, England	(*194*)
	----------	15 lb. (fenuron)	Water	60 percent	Injected into mud, 1 year, England.	(*194*)
	----------	20 lb. (fenuron)	do	99 percent in part of plot; 10 percent in part.	do	(*194*)
Monuron	----------	20 lb	Granules	27 percent; recovery in 2 years.	11 months, England	(*194*)
	----------	40 lb	do	53 percent; recovery in 2 years.	do	(*194*)
Monuron+sodium borate	----------	250 lb	Granules	69 percent; 40-percent recovery in 2 years.	11 months, England	(*194*)
	----------	500 lb	do	94 percent; 40-percent recovery in 2 years.	do	(*194*)
	----------	1,000 lb	do	20 percent	15 months, England	(*194*)
Diuron (WP)	----------	20 lb	Water, 100 gal	9 percent; strong recovery in 2 years.	11 months, England	(*194*)
	----------	40 lb	do	32 percent; strong recovery in 2 years.	do	(*194*)
	----------	40 lb	do	50 percent	15 months, England	(*194*)
	----------	60 lb	do	70 percent	do	(*194*)

Tamarix gallica (Saltcedar)

2,4-D	----------	2 lb	Water, 200–400 gal.	Excellent	Retreatment necessary, ground spray.	(*239*)
	----------	3 lb	Oil, 15–20 gal	do	Aircraft application	(*239*)

Typha spp. (Cattails)

2,4-D	----------	80–100 lb	Granules	None to complete	Treated May 7, checked June 24, pond tests, Ark.	([3])
	----------	5.01 lb	Diesel oil	90 percent	Treated Apr. 30, airplane, Fla.	(*226*)
2,4-D, IPE	----------	5 lb. (each)	Water, 5 gal	75 percent	Air treatment May 15, June 13, and July 17, checked Oct. 27, refuge.	(*242*)
2,4-D+2,4,5-T	----------	10 lb	Kerosene, 50 gal	80 percent	Treated Sept. 6, 1957, Fla	(*121*)
	----------	2 lb. (each)	Diesel oil, 3 gal	Satisfactory	Research trials, N.Y	(*97*)
Silvex, IOE	2 p.p.m	----------	----------	Satisfactory	Treated June 29, pond tests, NE.	(*148*)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Typha spp. (Cattails)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Dalapon	----------	20 lb	Water, 11 gal	55 percent	Treated May 18, 1956, plot 1, refuge.	(*242*)
	----------	10 and 5 lb	Water, 8 gal	75 percent	Retreated May 23 and June 18, 1957, checked in Oct. 1958, plot 1.	(*242*)
	----------	10 and 5 lb	do	60 percent	Retreated May 23 and June 18, 1957, checked in Oct. 1958, plot 2, refuge.	(*242*)
	----------	20 and 5 lb	Water, 11 gal	do	Treated May 18 and June 20 1956, checked in May 1957, plot 3, refuge.	(*242*)
	----------	10 and 5 lb	Water, 8 gal	80 percent	Retreated May 23 and June 18, 1957, checked in Oct. 1958, plot 3, refuge.	(*242*)
	----------	10 and 5 lb	Water, 11 gal	70 percent	Treated May 18 and June 20, 1956, checked in May 1957, plot 4.	(*242*)
	----------	10 and 5 lb	Water, 8 gal	80 percent	Retreated May 23, and June 18, 1957, checked in Oct. 1958, plot 4.	(*242*)
	----------	10 and 5 lb	do	40 percent	Retreated May 23 and June 18, 1957, checked in Oct. 1958, plot 5.	(*242*)
	----------	20 lb	do	60 percent	Treated May 18, 1956, checked in May 1957, plot 6.	(*242*)
	----------	10 and 5 lb	do	90 percent	Retreated May 23 and June 18, 1957, checked in Oct. 1958, plot 6.	(*242*)
	----------	20 lb	do	97 percent	Airplane, Fla	(*99*)
	----------	20 lb	Water, 5 gal	do	do	(*99*)
	----------	20 lb	Water, 8 gal	99 percent; killed in 4 months.	Air treatment June 7, 10 acres, refuge.	(*242*)
	----------	10 and 5 lb	do	65 percent	Air treatment May 15 and June 9, checked Oct. 22, refuge.	(*242*)
	----------	10 and 5 lb	do	75–98 percent	Air treatment June 13 and July 17, checked Oct. 27, refuge.	(*242*)
	----------	15 and 20 lb	Water	97-percent top kill	Research trials. refuges	(*97*)
	----------	20 lb	Water, 11 gal	95–100 percent	Airplane, Fla	(*99*)
	----------	20 lb	do	97 percent	do	(*99*)
	----------	20 and 5 lb	do	98 and 60 percent	Treated May 18 and June 20, airplane, percent of kill checked in Oct. 1956 and May 1957.	(*223*)
	----------	10 and 5 lb	do	97 and 70 percent	do	(*225*)
	----------	20 lb	do	95 and 55 percent	do	(*225*)
	----------	20 lb	Water, 8 gal	98 and 60 percent	do	(*225*)

Dalapon—Continued	----------	10 and 5 lb	Water, 8 gal	90–95 percent	Treated May 23 and June 18, airplane, 2d year treatment on plots. (226)
	----------	20 lb	do	99 percent	Treated June 18, airplane (226)
	----------	10 and 5 lb	do	do	Treated June 18 and July 16, airplane. (226)
	----------	10 and 5 lb	Water, 11 gal	97 percent	Treated May 18 and June 20, airplane. (225)
	----------	20 lb	Water, 8 gal	98 percent	Treated May 18, airplane (225)
	----------	27 lb	Water	97 percent	Treated May 19, airplane, N.C. (225)
	----------	22 lb	do	None	Treated May 15, sprayed, Ariz., checked in 3 months. (226)
	----------	10 and 5 lb	Water, 8 gal	90–95 percent	Treated May 23 and June 18, airplane, N.C. (226)
	----------	52.4 lb	Water	100 percent	Treated Aug. 8, sprayed, N.Y. (226)
Dalapon+2,4-D	----------	10 lb.+3.34 lb	Water, 11 gal.+ diesel oil, 5 gal.	50 percent	Treated May 18 and June 20, 1956, checked in May 1957, plot 2, refuge. (242)
	----------	20 lb.+3.34 lb	do	60 percent	Treated May 18 and June 20, 1956, checked in May 1957, plot 5. (242)
	----------	10 lb.+3.34 lb	do	85 and 50 percent	Treated May 18 and June 20, 1956, airplane, percent of kill checked in Oct. 1956 and May 1957. (225)
	----------	20 lb.+3.34 lb	do	90 and 60 percent	do (225)
	----------	20 lb.+3.34 lb	Water, 11 gal	90 percent	1st treatment May 18, airplane; 2d treatment June 20. (225)
Dalapon+2,4,5-T	----------	10 lb.+1 lb	Water, 11 gal	50–70 percent	Water less than 10 inches deep, airplane, Fla. (99)
	----------	20 lb.+1 lb	do	80–95 percent	Airplane, Fla (99)
Monuron	----------	15 lb		Unsatisfactory	Research trials, N.H (97)
Amitrole	----------	5 lb	Water, 200–400 gal.	90–100 percent	(211)
	----------	5 lb	Water, 200 gal	100 percent	Not replicated (211)
	----------	3 lb	do	do	do (211)
	----------	2 lb	do	do	do (211)
	----------	3 and 2 lb	Water, 8 gal	85 percent	Air treatment, June 13 and July 17, checked Oct. 27, refuge. (242)
	----------	5 lb	do	80 percent	Air treatment, June 13, checked Oct. 27, refuge. (242)
	----------	10 lb	Water, 16 gal	95 percent	do (242)
	----------	6 lb	Water, 5 gal	85 percent	Air treatment, July 17, 1957, checked in Oct. 1957, refuge. (242)
	----------	5 lb	Water	Satisfactory	Research trials, flooded, F & WS, Del. (97)
	----------	20 lb	do	Whitened leaves	Treated June 22, Calif (225)
	----------	16 and 24 lb	Water+oil	40 percent	Treated Aug. 17 and Aug. 25, sprayed, Ariz. (226)
	----------	4 lb	Water, 6 lb.+ ACP–M–357 and ACP–M–358 detergents.	100-percent top kill	Treated Aug. 13, airplane, Minn. (226)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Typha spp. (Cattails)—Continued						
Amitrole+dalapon		2 lb.+5 lb.	Water, 200–400 gal.	90–100 percent	Flowering through fruiting, ratings made at 12 and 14 months, N.Y., Del., Md., N.C.	(*211*)
		3 lb.+5 lb.	do	do	do	(*211*)
		2 lb.+5 lb.	Water, 5–8 gal.	Satisfactory	Research trials, flooded, F & WS.	(*97*)
AMS X		120 lb.	Water, 200 gal.	80 percent	Treated June 11, 1958, Fla.	(*121*)
2,3,6 TBA		6 lb.	Water	Fair to complete	Treated Aug., sprayed, Minn., control varied with soil density.	(*226*)
Dowpon		51 lb.	Water, 85 gal.	95 percent	Treated Sept. 6, 1957, Fla.	(*121*)
		16 lb.	Water, 100 gal.	do	Treated Sept. 10, 1957, Fla.	(*121*)
Typha angustifolia (Cattail)						
2,4-D, amine salt		3 to 6 lb.	Water	Ineffective	Irrigation canals	(*158*)
2,4-D, esters		3 to 6 lb.	Water	do	do	(*158*)
		6 lb.		Ineffective over long period.	do	(*157*)
2,4-D, EE		4.23 lb.	Water, 350 gal.	50-percent kill	Growing in water, resprayed in 5 weeks.	(*157*)
		4.23 lb.	do	80-percent kill	Growing above waterline, resprayed in 5 weeks.	(*157*)
		4.23 lb.	do	85-percent kill 5 months after treatment started.		(*157*)
		2 lb.		80-percent; less than 20-percent regrowth 2d year.	Not in water continuously	(*157*)
2,4-D, IPE		108.1 lb.		100 percent	Greenhouse tests, ⅔ applied 1st application, checked in 6 weeks after 2d application.	(*181*)
		96.6 lb.		do	do	(*181*)
		59 lb.		do	do	(*181*)
		33.9 lb.		do	do	(*181*)
		25.3 lb.		do	do	(*181*)
		15.4 lb.		do	do	(*181*)
		9.2 lb.		do	do	(*181*)
		7.5 lb.		do	do	(*181*)
		6.1 lb.		do	do	(*181*)
		3.9 lb.		95 percent	do	(*181*)
		3.3 lb.		90 percent	do	(*181*)
		2.7 lb.		85 percent	do	(*181*)
		6 to 8 lb.		Complete kill	Irrigation channels	(*180*)
2,4-D, sodium		13.7 lb.		50 percent	Greenhouse tests, checked 6 weeks after 2d application.	(*181*)
		12.6 lb.		40 percent	do	(*181*)

2,4-D, ester+diesel fuel		3 to 6 lb.+10 gal	Water, 190 gal	Excellent	Irrigation canals	(158)
		4 lb.+10 gal	do	Very good	do	(158)
		6 lb.+10 gal	do	do	do	(158)
		8 lb.+10 gal	do	Excellent	do	(158)
		12 lb.+10 gal	do	do	do	(158)
		4 lb.+10 gal	do	Fair to good	do	(158)
		6 lb.+10 gal	do	do	do	(158)
		8 lb.+10 gal	do	do	do	(158)
		12 lb.+10 gal	do	do	do	(158)
2,4-D, TCA		1.5 and 10 lb	Water, 100 gal. + W/S.	80–90 percent	2 applications per year	(158)
2,4-D, amine+AMS		3 to 6 lb.+20 to 40 lb.	Water+wetter sticker.	Fair to good	Irrigation canals	(158)
2,4-D, amine+TCA		3 to 6 lb.+20 to 40 lb.	do	do	do	(158)
2,4-D+AMS		1.8 lb.+320 lb		Resisted	do	(157)
		2 lb.+40 lb	Water, 80 gal	70 percent; 30-percent regrowth 2d year.	Not in water continuously	(157)
2,4-D, sodium+AMS		3 to 6 lb.+20 to 40 lb.	Water+wetter sticker.	Fair to good	Irrigation canals	(158)
2,4-D, sodium+TCA		3 to 6 lb.+20 to 40 lb.	do	do	do	(158)
2,4,5-T, esters		3 to 6 lb	Water	Ineffective	do	(158)
2,4,5-T	750 p.p.m			do	Heavy stands in irrigation ditches.	(157)
	1,125 p.p.m			do	do	(157)
TCA		109 lb		Ineffective over long period.	Irrigation channels	(157)
		163 lb		do	do	(157)
Dalapon		5 lb. (each)	Water	85 percent	2 applications, 2 weeks apart	(211)
		20 lb	Water, 11 gal	95 and 55 percent	1 application in summer, checked in fall and spring.	(99)
		20 and 5 lb	Water, 11 gal.+ diesel oil, 11 gal.	98 and 60 percent	2 applications, 1 month apart, checked in fall and spring.	(99)
		10 and 5 lb	do	97 and 70 percent	do	(99)
		20 lb	Water, 8 gal	98 and 60 percent	1 application, checked in fall and spring.	(99)
		10 and 5 lb	do	80–85 percent	Air treatment in May and June, 81 acres, refuge.	(98)
		20 lb	do	95 percent	Air treatment in June, 23 acres, refuge.	(98)
Dalapon+2,4-D		10 and 3.34 lb	Water, 11 gal.+ diesel oil, 5 gal.	85 and 50 percent	2 applications, 1 month apart, checked in fall and spring, 2,4-D last.	(99)
		20 and 3.34 lb	do	90 and 60 percent	do	(99)
Dalapon+amitrole		5 lb.+5 lb	Water	95 percent		(211)
MH		65.4 lb		None	Greenhouse tests, checked 6 weeks after 2d application.	(181)
Amitrole		5 lb	Water	75 percent		(211)
		15 lb	do	95 percent		(211)
		2.7 lb	do	Stunting only	Treated in Aug., sprayed, Minn.	(226)
		8 lb	do	Poor	do	(226)
		16 lb	do	Good	do	(226)
		20 lb	do	do	do	(226)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Typha angustifolia (Cattail)—Continued						
AMS+fenuron		120 lb.+10 lb	Water	10 percent		(*211*)
ATCA		218 lb		50 percent	Based on regrowth following year.	(*157*)
PCP		712 gal		25 percent	Greenhouse tests, checked 6 weeks after 2d application.	(*181*)
Typha domingensis (Cattail)						
2,4-D, ester		3.3 lb	Water	99 percent		(*174*)
2,4-D+wetting agent		4 lb	Water+VL-600 5%-25%.	80-90 percent	Marsh tests, sprayed on plots	(*224*)
		12 lb	do	5-80 percent	Least kill with 25 percent VL-600.	(*224*)
		4 lb	Water+Tergitol 1.5%-7.5%.	100 percent	Marsh tests, sprayed on plots	(*224*)
		12 lb	do	do	do	(*224*)
		4 lb	Water+Tween-20 7.5%.	do	do	(*224*)
2,4-D		4 lb		100 percent; no regrowth in 3 months.	Treated May 21	(*224*)
		4 lb. (each)	Water	99 percent; no regrowth in 6 months.	Treated June 11 and June 24	(*224*)
		5 lb	Diesel oil, 5 gal	90 percent	Treated May 11, June 7, July 11, and Aug. 7.	(*225*)
2,4-D, IPE		5 lb	Diesel oil, 5 gal	90 percent	Treated in May and June	(*225*)
		15 lb	do	80 percent	Air treatment, Apr., May, and July, 97 acres, refuge.	(*98*)
		5 lb. (each)	Diesel oil, 3 gal. (each).	90 percent	3 applications, airplane, Ga., surface water present.	(*226*)
2,4-D+dalapon		3.34 lb.+7.4 lb	Water	90 percent	Treated June 17, sprayed, Ga., surface water present.	(*226*)
Dalapon		20 lb	Water, 8 gal	99 percent	Air treatment, Apr., 7 acres, refuge.	(*98*)
		10 and 5 lb	do	80-85 percent	Air treatment, May and June, 81 acres, refuge.	(*98*)
		20 lb	do	95 percent	Air treatment, June, 23 acres, refuge.	(*98*)
		20 lb	Water, 11 gal	95-100 percent	Treated Apr. 5, airplane, some water coverage.	(*223*)
		20 lb	do	75 percent	Treated Apr. 30, airplane, surface water on areas.	(*225*)
		20 lb	Water, 8 gal	97 percent	do	(*225*)
		20 lb	Water, 5 gal	do	do	(*225*)
		20 lb	Water, 11 gal	95 percent	Treated May 18, airplane, shallow surface water.	(*225*)
		20 and 5 lb	do	98 percent	Treated May 18 and June 20, airplane.	(*225*)
		20 lb	do	100 percent	Airplane treatment	(*99*)

Dalapon+2,4,5-T	----------	10 lb.+1 qt	Water, 11 gal	50–55 percent	Treated Apr. 5, airplane, some water coverage.	(241)
	----------	10 lb.+1 qt	do	65–70 percent	do	(241)
	----------	20 lb.+1 qt	do	80–95 percent	do	(241)
	----------	20 lb.+1 qt	do	90–95 percent	do	(241)
Dalapon+2,4-D	----------	10 lb.+3.34 lb	Water, 11 gal	85 percent	Dalapon applied May 18, 2,4-D applied June 20, airplane.	(225)
MH	----------	5 lb	Water	95-percent top kill	Marsh tests, spraying on plots	(224)
	----------	10 lb	do	97-percent top kill	do	(224)
	----------	20 lb	do	99-percent top kill	do	(224)
	----------	30 lb	do	do	do	(224)
MH+2,4-D	----------	2.5 lb.+12 lb	Water	Complete; 10-percent regrowth in 3 months.	MH applied Mar. 20, 2,4-D, Apr. 5.	(224)
	----------	5 lb.+12 lb	do	Complete; 2-percent regrowth in 3 months.	MH applied Mar. 30, 2,4-D, Apr. 5.	(224)
	----------	10 lb.+12 lb	do	Complete; 2.5-percent regrowth in 3 months.	do	(224)
	----------	20 lb.+12 lb	do	Complete; 1-percent regrowth in 3 months.	do	(224)
	----------	20 lb.+4 lb	do	99 percent; 5-percent regrowth in 3 months.	MH applied May 21, 2,4-D, June 4.	(224)
	----------	5 lb.+4 lb	do	99 percent; no growth in 6 months.	MH applied June 11, 2,4-D, June 24.	(224)
	----------	10 lb.+4 lb	do	do	do	(224)
	----------	20 lb.+4 lb	do	do	do	(224)
	----------	30 lb.+4 lb	do	do	do	(224)
2,3,6 TBA	----------	3 lb	Diesel oil	10 percent; contact kill.	Treated May 5, plots under water.	(241)
	----------	9 lb	do	30 percent; contact kill.	do	(241)
	----------	15 lb	do	80 percent; contact kill.	do	(241)
Typha glauca (Cattail)						
Amitrole	----------	8 lb	Water	Poor	Treated in Aug., sprayed, Minn.	(226)
	----------	2.7 lb	do	Stunting only	do	(226)
	----------	16 lb	do	Good	do	(226)
	----------	20 lb	do	do	do	(226)
Typha latifolia (Cattail)						
2,4-D	----------	1.4 lb	Water, 2 gal	40 percent	Treated June 27, airplane	(224)
2,4-D, ester	----------	4 lb	Water, 50 gal	30 percent	Treated Aug. 11, spray	(224)
2,4-D, amine	----------	4 lb. (each)	Water, 50 gal. (each).	30–40 percent	Treated July 11 and Aug 10, spray.	(224)
2,4-D, Dowanol ester	1 percent	20 lb	Diesel fuel	90–95 percent	Pond tests	(2)
	1 percent	20 lb	Kerosene	do	do	(2)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Typha latifolia (Cattail)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
2,4-D	0.5 percent		Oil		Ponds; recommended rate	(*232*)
2,4-D (20 percent P)		100 lb		Retarded	Pond tests	(*197*)
2,4-D, ester		15.6 lb	Diesel oil, 9.3 gal	80–100 percent	Airplane application	(*174*)
2,4-D		1 lb	Kerosene, 25 gal	Good	2 quarts tributyl phosphate	(*174*)
2,4-D, BEE		6 to 8 lb. (each)	Diesel fuel	do	2 sprayings, 5–6 weeks apart, ground spray.	(*174*)
2,4-D, BE	0.2–0.4 percent.		Water	do	Pond tests (slow acting)	(*104*)
	0.25 percent		Diesel fuel	do	Pond tests	(2)
	1 percent		Water	do	do	(*149*)
	1 percent	10 lb	Diesel fuel	98 percent	do	(2)
	1 percent	10 lb	Kerosene	do	do	(2)
2,4-D, ME		3 lb	Kerosene	Fair to good	Lake tests, TVA	(*147*)
2,4-D, IPE		108 lb		100 percent	Greenhouse tests, ⅔ at first application, checked 6 weeks after 2d application.	(*181*)
		84.1 lb		do		
		55.7 lb		95 percent		
		46.8 lb		100 percent	do	(*181*)
		41.5 lb		do	do	(*181*)
		27.3 lb		do	do	(*181*)
		12 lb		do	do	(*181*)
		9.2 lb		85 percent	do	(*181*)
		7.5 lb		90 percent	do	(*181*)
		7 lb		95 percent	do	(*181*)
		6.3 lb		85 percent	do	(*181*)
		3.4 lb		80 percent	do	(*181*)
		1.4 lb		75 percent	do	(*181*)
		9 to 12 lb	Water	100 percent	Irrigation channels	(*180*)
		5 lb. (each)	Diesel fuel, 5 gal. (each).	80 percent	Air treatment, Apr., May, and July, 97 acres, refuge.	(*98*)
	0.5 percent	8 to 16 lb	Water+.2% dynawet.	Good top kill	Pond tests	(2)
	0.5 percent	8 to 16 lb	Water+.5% Roccal.	do	do	(2)
	0.5 percent	6 to 12 lb	Diesel fuel	Good	do	(2)
		4 to 8 lb	do	90–100 percent	do	(*210*)
2,4-D, sodium salt		17.5 lb		40 percent	Greenhouse tests, checked 6 weeks after 2d application.	(*181*)
		13.1 lb		60 percent	do	(*181*)
		3 lb	Water	Resistant	Lake tests, TVA	(*147*)
2,4-D, Na salt+TCA		1.2 lb.+10 lb	Water	Good	1 quart sulfonate emulsifier, ground spray.	(*174*)
2,4-D, nonvolatile Dow	1 percent	10 lb	Diesel fuel	100 percent	Pond tests	(2)
	1 percent	10 lb	Kerosene	do	do	(2)
2,4-D+2,4,5-T	0.6 percent	2 lb.+2 lb	Water, 60–80 gal	None	Spray application, 2 ponds, field tests, Ga.	(*236*)
	0.6 percent	2 lb.+2 lb	do	100 percent	do	(*236*)

2,4-D+2,4,5-T+dalpon+Tide	----------	1.5 lb.+7.5 lb.+3 lb.	Water, 80 gal	100 percent; killed less than 30 days in fall.	Spray application, 2 ponds, field tests, Ga.	(236)
	----------	1.5 lb.+15 lb.+3 lb.	do	100 percent	Spray application, field tests, Ga.	(236)
	----------	3 lb.+15 lb.+3 lb.	do	do	do	(236)
2,4-D, PGBEE	----------	4.8 lb	Diesel fuel	90–100 percent	Pond tests	(210)
2,4-D, TBP	5 percent	----------	Kerosene	Killed; appeared dead in 10 days.	----------	(122)
2,4-D, TEA	----------	3 lb	Water	Resistant	Lake tests, TVA	(147)
2,4,5-T, ester	0.6 percent	4 lb	Water, 60–80 gal	95 percent	Spray application, pond tests, Ga.	(236)
2,4,5-T	0.3 percent	----------	Water+.2% Tide	Good	Pond tests	(175)
	1 percent	10 lb	Diesel fuel	100 percent	do	(2)
	1 percent	10 lb	Kerosene	98 percent	do	(2)
	----------	1 lb	Water, 100 gal	None	Ditch tests, 15 months	(145)
	----------	2 lb	do	60 percent	do	(145)
	----------	3 lb	do	50 percent	do	(145)
Silvex	0.6 percent	4 lb	Water, 60–80 gal	100 percent	Spray application, pond tests, Ga.	(236)
TCA	1.p.p.m	----------	----------	Poor	Pond tests, N.J., 3–4 weeks	(252)
TCA+2,4-D, IPE	5 percent	168 lb	Water, 200 gal.+1% Tide.	Poor to fair	Pond tests	(2)
TCA+2,4-D, Na salt	5 percent+0.5 percent.	168 lb.+10 lb	do	Very effective	do	(2)
TCA+2,4,5-T	5 percent+1 percent.	168 lb.+33.6 lb	do	Effective	do	(2)
TCA+AMS	5 percent+0.5 percent.	168 lb. +10 lb	do	Very effective	do	(2)
TCA+silvex	5 percent+5 percent.	168 lb.+160 lb	do	Poor to fair	do	(2)
Dalapon	----------	10 lb.+20.8 lb	Water	98 percent	do	(210)
	----------	4 lb	Diesel fuel+water, 4–80 gal.	100 percent	Spray application, pond tests, Ga.	(236)
	----------	16 lb	Water, 80 gal	do	do	(236)
	----------	8 lb	do	do	do	(236)
	----------	10 and 5 lb	Water, 8 gal. (each)	80–85 percent	Air treatment May and June, 81 acres, refuge.	(98)
	----------	2 lb	Water	----------	Ponds in Israel; recommended rate.	(201)
	----------	10 lb	Water, 4 gal	90 percent	Aerial application, growing in less than 8 inches water, Mich.	(152)
	----------	10 lb	do	65 percent	do	(152)
	----------	20 to 25 lb	Water, 100 gal	----------	Suggested for general use	(169)
	----------	10 to 20 lb	Water, 10 gal	Satisfactory	Aerial application	(212)
	----------	6.8 lb	Water, 100 gal	None	Ditch tests, 15 months	(145)
	----------	13.6 lb	do	60 percent	do	(145)
	----------	20.4 lb	do	100 percent	do	(145)
	----------	20 lb	Water	90–99 percent	Pond tests, 8 months	(210)
	----------	10 lb	do	Partial	do	(210)
	1.4 percent	----------	do	Effective	Dewatered area of pond	(2)
	2.0 percent	----------	do	do	do	(2)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Typha latifolia (Cattail)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Dalapon+2,4,5-T		6.8 lb.+1 lb	Water, 100 gal	90 percent	Ditch tests, 15 months	(245)
		6.8 lb.+2 lb	do	do	do	(245)
		6.8 lb.+3 lb	do	80 percent	do	(245)
		13.6 lb.+1 lb	do	100 percent	do	(245)
		13.6 lb.+2 lb	do	do	do	(245)
		13.6 lb.+3 lb	do	do	do	(245)
		20.4 lb.+1 lb	do	do	do	(245)
		20.4 lb.+2 lb	do	do	do	(245)
		20.4 lb.+3 lb	do	do	do	(245)
Monuron	5 p.p.m			Killed	Pond tests, Oreg	(109)
	10 p.p.m			do	do	(109)
		50 lb		50 percent in 22 days; 80 percent in 4 months.	Pond tests, N.J	(159)
		100 lb		do	do	(159)
Diuron	2.5 p.p.m			Injured	Pond tests, Oreg	(109)
MH		80.4 lb		20 percent	Greenhouse tests, checked 6 weeks after 2d application.	(181)
Amitrole		10 lb	Water, 300 gal		Suggested for general use	(169)
		10 lb	Water		Based on pond tests; recommended rate.	(210)
		6 lb	Water, 320 gal	100 percent	Pond tests	(91)
		10 to 12 lb	Water		Pond tests; recommended rate.	(94)
		5 lb	Water, 100 gal	Eradicated	Ditchbank tests	(95)
		5 lb	do		Recommended rate	(93)
		15 to 20 lb	Water		Pond tests; rate required for control.	(96)
		10 to 20 lb	do	Complete	do	(113)
		12 lb	do	39-percent kill	do	(127)
		4 to 8 lb	do	Effective	do	(136)
		20 lb. (each)	do	97 percent	2 applications, pond tests	(138)
		5 lb	do	Complete	Marsh tests	(174)
		8 lb	Water, 100 gal	80-percent top growth		(174)
Amitrole + dalapon		10 lb. + 20 lb	Water		Based on pond tests; recommended rate.	(94)
Amitrole + erbon		3.4 lb. + 20.8 lb	do	96 percent	Pond tests	(210)
Erbon	1.2 percent	8 lb	Water, 60–80 gal	None	Spray application, pond tests, Ga.	(236)
		10.4 lb	Diesel fuel	90 percent	Pond tests	(210)
		10 to 15 lb	do	Partial kill	do	(2)
		10 to 15 lb	Water	Poor kill	do	(2)
		10 to 15 lb	Water + 0.1 percent dynawet.	Killed tops	do	(2)
AMS		150 to 300 lb	Water + detergent.	Killed tops; plants recovered.	Pond tests	(103)
		400 lb	Water + Vatsol OS	Partial kill	do	(103)
AMS+TCA		10 lb. + 10 lb	Water, 200 gal	Unsatisfactory	Pond tests	(2)
Chlorox		400 lb		Complete kill	Pond tests, N.J	(159)
Copper sulfate	2 p.p.m			Unaffected		(230)
	2 p.p.m			do	Hard water	(234)

TABLE 2.—*Effects of copper sulfate on certain aquatic organisms*

Organism	Concentration	Rate per acre	Control	Remarks	Reference
	P.p.m.	*Pounds*			
Schizomycetes:					
Beggiatoa	5	41. 5	Good	In ponds or lakes	(*146*)
Beggiatoa	5		do	do	(*238*)
Cladothrix	. 2	1. 7	do	do	(*146*)
Cladothrix	. 2		do	do	(*238*)
Crenothrix	0. 33–0. 5	2. 8–4. 2	do	do	(*146*)
Sphaerotilis natans	. 4	3. 3	do	do	(*146*)
Fungus:					
Leptomitus	. 4	3. 3	do	do	(*146*)
Saprolegnia	. 18	1. 5	do	do	(*146*)
Rotifers: Stentor	. 24	2.	Killed	do	(*146*)
Crustacea:					
Cyclops	2	16. 6	do	do	(*146*)
Daphnia	2	16. 6	do	do	(*146*)

Effects of Aquatic Herbicides on Various Algae

TABLE 3.—*Effects of certain aquatic herbicides on various plankton algae*

Species of algae	Toxicity of each species for—						Reference
	$CuSO_4 \cdot 5H_2O$	2,3-DNQ	DAC	RADA	RADS	ZDD	
	P.p.m.	*P.p.m.*	*P.p.m.*	*P.p.m.*	*P.p.m.*	*P.p.m.*	
BLUE-GREEN ALGAE:							
Calothrix braunii	8	8	1	0. 5	1	0. 5	(*173*)
Cylindrospermum licheniforme	1	8	1	. 5	. 5	. 016	(*173*)
Microcystic aeruginosa	. 25	. 25	. 5	. 125	. 25	. 002	(*173*)
Nostoc muscorum	2	. 5	. 5	. 25	. 5	. 5	(*173*)
Phormidium tenue	. 5	4	. 125	. 25	. 25	. 25	(*173*)
Plectonema nostocorum	. 25	. 25	1	1	2	. 032	(*173*)
Symploca erecta	8	2	. 5	. 25	1	1	(*173*)
GREEN ALGAE:							
Ankistrodesmus falcatus	2	32+	4	4	2	1	(*173*)
A. falcatus (a)	8	8	1	1	2	1	(*173*)
Chlamydomonas communis	2	2	. 25	. 5	. 25	. 25	(*173*)
C. paradoxa	1	1	. 5	. 5	1	. 25	(*173*)
Chlorella variegata	. 5	4	. 5	. 5	1	1	(*173*)
Chlorococcum botryoides	2	32+	2	1	2	2	(*173*)
C. humicola	. 5	8	2	. 5	2	. 125	(*173*)
Coccomyxa simplex	. 5	32	2	4	16	4	(*173*)
Coelastrum proboscideum	2	32	1	2	2	. 5	(*173*)
Gloeocystis grenillei	. 5	4	. 5	. 125	. 25	. 5	(*173*)
Mesotaenium caldoriorum	2	4	. 25	. 5	. 25	. 25	(*173*)
Oocystis lacustris	2	32	. 25	1	1	1	(*173*)
O. marsonii	2	32+	. 5	1	2	1	(*173*)
Scenedesmus brasilensis	2	32+	. 5	1	2	1	(*173*)
S. obliquus	16	32+	. 25	1	. 5	1	(*173*)
Sphaerella lacustris	. 5	16	1	. 032	. 25	. 125	(*173*)
Stigeoclonium nanum	2	8	. 25	. 25	1	. 125	(*173*)
DIATOMS:							
Achnanthes linearis (strain 1)	1	2	. 5	. 125	. 125	. 063	(*173*)
A. linearis (stain 2)	1	1	. 5	. 125	. 5	. 063	(*173*)
Gomphonema parvulum	. 25	1	. 5	. 25	. 125	. 016	(*173*)
Nitzschia palea (strain 1)	. 25	1	. 5	. 125	. 125	. 125	(*173*)
N. palea (strain 2)	1	1	. 25	. 25	. 125	. 032	(*173*)
N. palea (strain 3)	. 5	. 5	. 25	. 25	. 5	. 016	(*173*)

TABLE 4.—*Effects of certain aquatic herbicides on various algae*

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
			Chara spp.		
	P.p.m.[1]				
Silvex, PGBEE	2		Retarded growth	Pond tests, 6 weeks	(2)
	5		Greatly reduced growth.	Pond tests, 6 months	(2)
	1.5		None	Pond tests, N.Y	(171)
	1.2		Checked growth	do	(191)
Silvex, PGBEE+dalapon	0.33+0.33		100 percent	Pond tests, Ga	(235)
Silvex acid in acetone or ethanol	5		None; stimulated growth.	Plastic pools, Ala	(211)
Endothal, granules	5		None	Tests, Ill	(171)
2,4-D, IOE (granules)		30 lb	do	Pond tests, Ala	(171)
		10, 20, 40 lb	do	Pond tests, La	(211)
		30 lb	do	Pond test, Fla	(211)
		40 to 86 lb	do	Pond tests, Ga	(235)
2,4-D acid in acetone	5		None; stimulated growth	Plastic pools, Ala	(211)
2,4-D acid in ethanol	5		do	do	(211)
2,4-D, Na salt	15		do	Pond tests	(2)
2,4-D, granules		8 lb	do	do	(2)
2,4-D, TEA	10		do	Aquarium tests	(234)
2,4-D, TBP		10 lb	do	Sprayed over dried pond bottom.	(234)
	10		do	Aquarium test	(234)
2,4-D	100		Poor	Greenhouse test, 20 days	(198)
2,4,5-T	3		None	Pond test	(2)
Sodium arsenite	3		100 percent	Pond tests, Ga	(235)
	5		None	Concentration as As_2O_3; pond test.	(230)
	16		do	do	(230)
	4		do	Pond tests	(2)
	100		No kill	Greenhouse test	(198)
AMS	10		None	Aquarium tests	(234)
IPC	10		Arrested growth, no kill.	do	(234)
MCPA	10		None	do	(234)
Copper sulfate	0.1–1.0		Good kill	Aquarium and pond tests.	(244) (206)
	1.5		Killed	Pond tests	(230)
	0.7–1.0		do	do	(2)
	0.1–0.5		To kill		(146)
	0.2–5		do	In ponds or lakes	(238)
	1.5–2		do	In hard water	(234)
Delrad	0.2–0.4		Fair to good kill	Pond tests	(2)
	.75		30 percent	Pond tests, N.Y	(133)
	1		35 percent	do	(133)
	1			Suggested for trial use	(169)
Delrad 70	.5		Satisfactory	Research trials, drag, N.J.	(97)
Delrad 50	1.4		do	Research trials, spray, N.J.	(97)
Simazine (granules)		5 to 10 lb	do	Pond tests, NE., N.C	(135)
Dichlone	.5		20 percent	Pond tests, N.Y	(133)
	.1		10 percent	do	(133)
Aromatic solvents	300		Very susceptible	Irrigation channels, 30-minute contact.	(239)
Ammonium thiocyanate	100		100 percent	Greenhouse test, 18 days	(198)
Erbon	3.9		Satisfactory	Research trials, spray, N.J.	(97)

See footnotes at end of table, p. 31.

TABLE 4.—*Effects of certain aquatic herbicides on various algae*—Continued

Cladophora spp.

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
	P.p.m.[1]				
Copper sulfate	0.5		Fair to good kill		(*244*)
	.5		Good	In ponds	(*146*)
	.5		50 percent	Pond test, N.Y	(*133*)
	1			Recommended rate for control in ponds or lakes.	(*238*)
	1			do	(*177*)
	1		60 percent	Pond tests, N.Y	(*133*)
	1		Reduced to killed	Hard-water ponds	(*205*)
	1.5		do	do	(*230*)
	2		do	do	(*234*)
	.5		None	30-minute contact, 6-week beaker tests (carrier—water).	(*181*)
	5		do	do	(*181*)
	10		do	do	(*181*)
	20		do	do	(*181*)
	40		do	do	(*181*)
	80		do	do	(*181*)
Fermate	3		80-percent kill	Pond tests, N.Y	(*133*)
Sodium arsenite	4–5		Killed	Pond tests	(*230*)
	4		97–100 percent	Pond tests, N.Y	(*133*)
	.5		None	30-minute contact, 6-week beaker tests (carrier—water).	(*181*)
	5		do	do	(*181*)
	10		do	do	(*181*)
	20		do	do	(*181*)
	40		do	do	(*181*)
	80		do	do	(*181*)
Delrad	.33		50 percent	Pond tests, N.Y	(*133*)
	.5		None	do	(*133*)
Endothal	1		No kill	30-minute contact	(*102*)
	10		do	do	(*102*)
	20		do	do	(*102*)
	5		None	30-minute contact, 6-week beaker tests (carrier—water).	(*181*)
	50		do	do	(*181*)
	100		do	do	(*181*)
	200		do	do	(*181*)
	400		do	do	(*181*)
	400		do	do	(*181*)
Simazine		10 lb	Killed	Pond-edge tests, Mo	(*135*)
	1.5–3	10 to 20 lb	do	Pond tests	(*135*)
Kerosene	5		100 percent	30-minute contact, 6-week beaker tests (carrier—water).	(*181*)
	50		do	do	(*181*)
	100		do	do	(*181*)
	200		do	do	(*181*)
	400		do	do	(*181*)
	800		do	do	(*181*)
Benzene	5		100 percent	30-minute contact, 6-week beaker tests, (carrier—water).	(*181*)
	50		do	do	(*181*)
	100		do	do	(*181*)
	200		do	do	(*181*)
	400		do	do	(*181*)
	800		do	do	(*181*)

See footnotes at end of table, p. 31.

TABLE 4.—*Effects of certain aquatic herbicides on various algae*—Continued

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
			Cladophora spp.—Continued		
	P.p.m.[1]				
Dichlorobenzene	5		100 percent	30-minute contact, 6-week beaker tests, (carrier—water).	(*181*)
	50		do	do	(*181*)
	100		do	do	(*181*)
	200		do	do	(*181*)
	400		do	do	(*181*)
	800		do	do	(*181*)
Trichlorobenzene	5		100 percent	30-minute contact, 6-week beaker tests, (carrier—water).	(*181*)
	50		do	do	(*181*)
	100		do	do	(*181*)
	200		do	do	(*181*)
	400		do	do	(*181*)
	800		do	do	(*181*)
Rosin amine D acetate	5		None	30-minute contact, 6-week beaker tests, (carrier—water).	(*181*)
	50		do	do	(*181*)
	100		do	do	(*181*)
	200		do	do	(*181*)
	400		do	do	(*181*)
	800		do	do	(*181*)
Monuron (CMU)	5		None	30-minute contact, 6-week beaker tests, (carrier—water).	(*181*)
	50		do	do	(*181*)
	100		do	do	(*181*)
	200		do	do	(*181*)
	400		do	do	(*181*)
	800		do	do	(*181*)
			Compsopogon sp.		
Delrad	3		Satisfactory	Irrigation canals, 15-minute contact.	([3])
	5			Irrigation canals, 20-minute contact; recommended rate.	([3])
			Hydrodictyon spp.		
Copper sulfate	0.1		To kill	In ponds or lakes	(*177*)
	.33		Good	5 daily applications, pond tests.	(*183*)
	.1		To kill	In ponds or lakes	(*244*)
	0.1–0.2		do	do	(*205*)
	2		Partial kill	Pond tests	(*230*)
	.06		30 percent in 5 days; 12 percent in 20 days.	In lakes	(*128*)
	1		70 percent	Pond tests, N.Y	(*133*)
	.5		50 percent	do	(*133*)
	.1		Good	In ponds or lakes	(*146*)
Delrad	0.2–0.4		Poor to good kill	Pond tests	([2])
	.25		40–50 percent	Pond tests, N.Y	(*133*)
	.33		60 percent	do	(*133*)
	.5		90–95 percent	do	(*133*)
	1		100 percent	do	(*133*)
	.75		15 percent	Float in ponds, N.Y	(*133*)
	0.4–0.5		Ineffective	Pond tests, Ala., 75° F. or more, repeated applications.	(*209*)
	0.3–0.4		Partial	Pond tests, Ala., 65° F., repeated applications.	(*209*)

See footnotes at end of table, p. 31.

TABLE 4.—*Effects of certain aquatic herbicides on various algae*—Continued

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
			Hydrodictyon spp.—Continued		
	P.p.m.[1]				
Dichlone	0.1–0.15		Good	Pond tests	(*132*)
	5		No effect	Ricefields and laboratory.	(*184*)
	2.5		Killed	Pond tests	(*230*)
	2–4		Fair to good kill	Pond tests, plants actively growing.	([2])
	8		Poor kill	Pond tests, plants not growing.	([2])
Sodium arsenite	4		97–100 percent	Pond tests, N.Y.	(*133*)
	4		Partial	Pond tests, Ala., 2 applications, 1–2 weeks apart.	(*209*)
	8		do	Pond tests, Ala., 1 application.	(*209*)
2,4-D, IOE (granules)		43.5 lb	None	Applied on surface scum, Ala.	(*211*)
			Microcystis aeruginosa		
o-aminophenol	2		100 percent	Screening tests	(*134*)
p-aminophenol	1		do	do	(*134*)
p-aminophenol·HCl	1		do	do	(*134*)
p-methylaminophenol sulfate	.5		do	do	(*134*)
2,4-diaminophenol·diHCl	2		do	do	(*134*)
Hydroquinone diacetate	1		do	do	(*134*)
Hydroxylamine·HCl	5		50 percent	do	(*134*)
Hydroxylammonium benzoate	10		100 percent	do	(*134*)
Hydroxylammonium chloride	2		do	do	(*134*)
Hydroxylammonium phosphate	2		do	do	(*134*)
Hydroxylammonium sulfate	2		do	do	(*134*)
Propionhydroxamic acid	10		do	do	(*134*)
2,4-dinitrophenylhydrazine				do	(*134*)
p-nitrophenylhydrazine	10		100 percent	do	(*134*)
p-nitrophenylhydrazine·HCl	1		50 percent	do	(*134*)
Acetyl phenylhydrazine	20		100 percent	do	(*134*)
Phenylhydrazine·HCl	10		do	do	(*134*)
p-aminodimethylaniline	2		do	do	(*134*)
p-aminodimethylaniline·HCl	2		do	do	(*134*)
	1		do	do	(*134*)
Tetramethyl-p-phenylenediamine	4		100 percent	Screening tests	(*134*)
Benzidine	20		50 percent	do	(*134*)
o-phenanthroline	.5		100 percent	do	(*134*)
Malachite green	5		do	do	(*134*)
Methylene blue	.5		do	do	(*134*)
Methyl green	10		do	do	(*134*)
Crystal violet	2		do	do	(*134*)
1,4-anthraquinone (Quinizarin)	20 mg./l.		Not toxic	do	(*134*)
o-aminophenol-p-sulfonic acid	20 mg./l.		do	do	(*134*)
Aminophenolmethyl ether (p-anisidine).	20 mg./l.		do	do	(*134*)
Hydroquinone monomethyl ether	20 mg./l.		do	do	(*134*)
Aminohydroquinone dimethyl ether.	20 mg./l.		do	do	(*134*)
2-aminoresorcinol·HCl	20 mg./l.		do	do	(*134*)
m-aminophenol	20 mg./l.		do	do	(*134*)
m-phenylenediamine·di HCl	20 mg./l.		do	do	(*134*)
1-isopropyl-2-nonyl-4,4-dimethyl-2-imidazoline.	2		100 percent	do	(*134*)
1-isopropyl-2-(8-heptadecenyl)-4,4-dimethyl(-2-imidazoline).	1		do	do	(*134*)
1-isopropyl-2-undecyl-4,4-dimethyl-2-imidazoline.	2		do	do	(*134*)

See footnotes at end of table, p. 31.

TABLE 4.—*Effects of certain aquatic herbicides on various algae*—Continued

Microcystis aeruginosa—Continued

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
	P.p.m.[1]				
Imidazoline from N(2-amino-isobutyl)-isopropylamine and linseed oil.	2		100 percent	Screening tests	(*134*)
1-(2-ethylhexyl)-2-undecyl-1,4,5,6-tetra-hydropyrimidine.	2		do	do	(*134*)
3-benzyl-5,5-dimethyl-2-imidazolinethione.	10		do	do	(*134*)
Cetylpyridinium bromide	2		do	do	(*134*)
Cetyltrimethyl ammonium bromide.	2		do	do	(*134*)
2,3,5-triphenyltetrazolium chloride.	2.5		do	do	(*134*)
2,4-dichlorobenzylnicotinium chloride.	5		do	do	(*134*)
Acriflavin	1		do	do	(*134*)
Quaternary ammonim salts	2		do	do	(*134*)
Tetrachlorobenzoquinone (chloronil).	20 mg./l.		Not toxic	do	(*134*)
Tetrahydroxyquinone (disodium salt).	20 mg./l.		do	do	(*134*)
2,5-diphenyl-p-quinone	20 mg./l.		do	do	(*134*)
p-dimethyl-aminoazobenzene	20 mg./l.		do	do	(*134*)
1,2-acenaphtenequinone	20 mg./l.		do	do	(*134*)
Potassium cyanide	20		90 percent	do	(*134*)
Methylamine·HCl	20		100 percent	do	(*134*)
Phenylthiourea	20		50 percent	do	(*134*)
Aniline	20		do	do	(*134*)
m-dinitrobenzene	5		do	do	(*134*)
8-hydroxyquinone	5		100 percent	do	(*134*)
α-naphthol	10		do	do	(*134*)
β-naphthol	20		do	do	(*134*)
Atabrine	1		do	do	(*134*)
α-benzene hexachloride	16 percent saturated		50 percent	do	(*134*)
Trinitrotoluene	8		100 percent	do	(*134*)
Aquasan (colloidal silver)	.75		do	do	(*134*)
Copper sulfate	.2		do	do	(*134*)
2,4-D	250		Resistant	do	(*134*)
Indole-3-acetic acid	20 mg./l.		do	do	(*134*)
α-naphthaleneacetic acid	20 mg./l.		do	do	(*134*)
Quinone	.5		100 percent	do	(*134*)
Hydroquinone	.5		do	do	(*134*)
Quinhydrone	.5		do	do	(*134*)
Catechol	5		do	do	(*134*)
3,6-dichloro-2,5-dimethoxybenzoquinone.	16 percent saturated		75 percent	do	(*134*)
Tetrachlorohydroquinone	21 percent saturated		100 percent	do	(*134*)
1,4-naphthoquinone	1 percent saturated		do	do	(*134*)
2-methyl-naphthoquinone	1 percent saturated		do	do	(*134*)
2-dimethylamino-3-chloronaphthoquinone.	1 percent saturated		do	do	(*134*)
Quinone chlorimide	.5		do	do	(*134*)
2,3-dichloronaphthoquinone	2 mg./l.		do	do	(*134*)
Phenanthraquinone	80 mg./l.		95 percent	do	(*134*)

Nitella spp.

Copper sulfate	0.1–0.18		Killed	Lake tests, N.Y.	(*146*)
	.1		To kill	In lakes	(*177*)

See footnotes at end of table, p. 31.

TABLE 4.—*Effects of certain aquatic herbicides on various algae*—Continued

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
		Oedogonium spp.			
	P.p.m.[1]				
Delrad	0. 2–0. 3		Good kill		(2)
Roccal	0. 1–0. 2		do	At water temperatures less than 70° F.	(2)
Dichlone		8 oz./6,000 sq. ft.	Satisfactory	Research trials, N.J.	(97)
Sodium arsenite	405		Killed	Pond tests	(230)
Copper sulfate	. 5–1		do	Soft water ponds	(2)
	1. 5		Partial kill	Hard water ponds	(234)
		Pithophora spp.			
Silvex, PGBEE	2		Fair to good; plants dying within 6 weeks.	Pond tests	(2)
	5		90–100 percent; no regrowth within 6 months.	do	(2)
Simazine	1. 5–3		Killed	Pond tests	(135)
Borascu	5		Retarded growth	do	(2)
	12		Killed or retarded growth.	do	(2)
2,4-D, Na salt	. 25		None	Pond tests	(2)
		4 lb	do	2 treatments 2 weeks apart on confined plots in ponds (carrier—water).	(2)
2,4-D, BE	2. 5		None	Pond test	(2)
		4 lb	do	2 treatments 2 weeks apart on confined plots in ponds (carrier—diesel fuel).	(2)
		4 lb	do	2 treatments 2 weeks apart on confined plots in ponds (carrier—water).	(2)
		8 lb	do	do	(2)
Copper sulfate	7. 8		None	Applied over 3 weeks, pond tests.	(2)
	. 33		Caused browning	Metered into irrigation channels.	(184)
	2		None	2 treatments 2 weeks apart on confined plots in ponds.	(2)
Delrad	Less than .2		Poor kill	Pond tests	(2)
	0. 2–0. 4		Good kill	Temporary control in pond tests (float or drag).	(2)
	. 7		None	Aquarium test (affinity for glass).	(2)
Diuron	. 3		Arrested growth	Pond test	(2)
	1. 2		Killed	do	(2)
$KMnO_4$	5		None	Pond tests	(2)
Dichlone	5		do	Ricefields	(184)
Roccal+Delrad	0. 2+0. 2		Good kill	Pond tests	(2)
Roccal	0. 2–0. 4		Partial kill	do	(2)
Sodium arsenite	4		Poor to good kill	Pond tests; concentration as As_2O_3.	(2)
	8		Good kill	do	(2)
	45		None	Pond tests with high iron content; concentration as As_2O_3.	(209)
	12–16		Partial	Pond tests, Ala.	(209)

See footnotes at end of table, p. 31.

TABLE 4.—*Effects of certain aquatic herbicides on various algae*—Continued

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
		Pithophora spp.—Continued			
	P.p.m.[1]				
2,4,5-T	2.5		None	Pond test	(2)
Nigrosine	1.5–2		do	Ponds colored so only 18 inches depth could be seen for 2 months.	(2)
TCA		4 lb	do	2 treatments 2 weeks apart on confined plots in ponds (carrier—water).	(2)
Na PCP (granules)	1		do	2 treatments 2 weeks apart on confined plots in ponds.	(2)
		Rhizoclonium spp.			
Delrad	0.2–0.4		Partial to good kill		(2)
Roccal	0.1–0.2		Good kill		(2)
Copper sulfate	0.5–0.1		Poor to good kill	Soft-water ponds	(2)
		Spirogyra spp.			
Copper sulfate	0.04–1		Fair to good kill	Pond tests	(*177*) (*206*)
	.12		To kill	In ponds or lakes	(*244*)
	1		None	Pond tests (hard water)	(*230*)
	0.5–1		Fair to excellent kill	Pond tests	(2)
	0.2–0.4		To kill	In ponds or lakes	(*205*)
	1		100 percent	Pond tests, N.Y	(*133*)
	.12		Good	In ponds or lakes	(*146*)
	0.05–0.3			To control in ponds or lakes.	(*238*)
	.5		None	30-minute contact, 6-week beaker tests.	(*181*)
	5		do	do	(*181*)
	10		do	do	(*181*)
	20		do	do	(*181*)
	40		do	do	(*181*)
	80		100 percent	do	(*181*)
	.73 and .36		Satisfactory	Research tests, N.J. (2 treatments).	(*97*)
	0.5–1.5		do	Research trials, N.J	(*97*)
Delrad	0.2–0.3		Good kill	Pond tests	(2)
	.25		40–50 percent	Pond tests, N.Y	(*133*)
	.5		90–95 percent	do	(*133*)
	3		Satisfactory	Irrigation channels, 15-minute contact.	(3)
	5			Irrigation channels, 20-minute contact, recommended rate.	(3)
	5.1		Good for 7 miles	In concrete-lined irrigation channel, 30-minute contact.	(3)
Delrad 70	0.75–0.9		Satisfactory	Research tests, N.J	(*97*)
Delrad 50	.8		do	do	(*97*)
Sodium arsenite	1.7–2		No kill	Pond tests	(*230*)
	4		Unaffective	do	(*230*)
	4		97–100 percent	Pond tests, N.Y	(*133*)
	.5		None	30-minute contact, 6-week beaker tests.	(*181*)
	5		do	do	(*181*)
	10		do	do	(*181*)
	20		do	do	(*181*)
	40		do	do	(*181*)
	80		do	do	(*181*)

See footnotes at end of table, p. 31.

TABLE 4.—*Effects of certain aquatic herbicides on various algae*—Continued

Spirogyra spp.—Continued

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
	P.p.m.[1]				
Dichlone	.5		None	Pond tests, N.Y.	(133)
		8 oz./1,000 sq. ft.	Satisfactory	Research trials, N.H.	(97)
	0.1–0.15		Good	Pond tests	(182)
Polyrad 0200	.2		Good kill	Pond tests	(2)
Roccal	0.1–0.2		Good	At temperatures below 70° F., pond tests.	(2)
Fermate	.5		90 percent	Pond tests, N.Y.	(133)
Kerosene	5		100 percent	30-minute contact, 6-week beaker tests.	(181)
	50		do	do	(181)
	100		do	do	(181)
	200		do	do	(181)
	400		do	do	(181)
	800		do	do	(181)
Benzene	5		100 percent	30-minute contact, 6-week beaker tests.	(181)
	50		do	do	(181)
	100		do	do	(181)
	200		do	do	(181)
	400		do	do	(181)
	800		do	do	(181)
Dichlorobenzene	5		100 percent	30-minute contact, 6-week beaker tests.	(181)
	50		do	do	(181)
	100		do	do	(181)
	200		do	30-minute contact, 6-week beaker tests (carrier—water).	(181)
	400		do	do	(181)
	800		do	do	(181)
Trichlorobenzene	5		100 percent	30-minute contact, 6-week beaker tests (carrier—water).	(181)
	50		do	do	(181)
	100		do	do	(181)
	200		do	do	(181)
	400		do	do	(181)
	800		do	do	(181)
Rosin amine D acetate	5		None	30-minute contact, 6-week beaker tests (carrier—water).	(181)
	50		do	do	(181)
	100		do	do	(181)
	200		do	do	(181)
	400		do	do	(181)
	800		do	do	(181)
Endothal	5		None	30-minute contact, 6-week beaker tests (carrier—water).	(181)
	50		do	do	(181)
	100		do	do	(181)
	200		do	do	(181)
	400		do	do	(181)
	800		do	do	(181)
Monuron (CMU)	5		None	30 minutes contact, 6-week beaker tests (carrier—water).	(181)
	50		do	do	(181)
	100		do	do	(181)
	200		100 percent	do	(181)
	400		do	do	(181)
	800		do	do	(181)
Simazine		10 lb	Killed	Pond tests	(135)
Oxalic acid	100		do	In 5 days	(176)

See footnotes at end of table, p. 31.

TABLE 4.—*Effects of certain aquatic herbicides on various algae*—Continued

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
			Spirogyra spp.—Continued		
	P.p.m.[1]				
Virac	10		100 percent	2-day exposure, jar tests	(*110*)
	5.6		None	2-week exposure, jar tests.	(*110*)
Chelamine-3B	5.6		100 percent	1.5-day exposure, jar tests.	(*110*)
	1		do	8-day exposure, jar tests	(*110*)
Algine	3.2		100 percent	2.5-day exposure, jar tests.	(*110*)
	1		None	2-week exposure, jar tests.	(*110*)
Algine C	5.6		100 percent	5.5-day exposure, jar tests.	(*110*)
Erbon	1.5		Promising	Research trials, spray, N.J.	(*97*)
			Ulothrix spp.		
Delrad	3		Killed	Irrigation canals, 15-minute contact.	(3)
	5			Irrigation canals, 20-minute contact; recommended rate.	(3)
Copper sulfate	.2		Good	In ponds or lakes	(*146*)
	.2		do	do	(*238*)
	.2		do	do	(*244*)
			Zygnema spp.		
Copper sulfate	0.05–0.7		Fair to good kill		(*206*)
	0.05–0.7		To kill	In lakes	(*205*)
	.5		do	In ponds and lakes	(*177*)
	.5		do	do	(*244*)
	.5		Good	do	(*146*)
	.5		97 percent	Pond tests	(*133*)
	1		100 percent	do	(*133*)
Delrad	0.2–0.3		Good kill	Pond tests, Ala	(2)
	.25		50 percent	Pond tests, N.Y	(*133*)
	.33		85 percent	Pond tests	(*133*)
	.5		90 percent	do	(*133*)
	.8		Satisfactory	Research trials, N.J	(*97*)
Dichlone	.1		None	Pond tests	(*133*)
	.25		do	do	(*133*)
Sodium arsenite	4		97 percent	Pond tests	(*133*)

See footnotes at end of table, p. 31.

TABLE 4.—*Effects of certain aquatic herbicides on various algae*—Continued

1—*Cylindrospermum licheniforme*
2—*Microcystis aeruginosa*
3—*Scenedesmus obliquus*
4—*Chlorella variegata*
5—*Gomphonema parvulum*
6—*Nitzschia palea*

[Species indicated by numbers in Control column]

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
	P.p.m.[1]				
Copper sulfate (anhydrous)	2		1, 2, 4, 5, 6	Screening tests	(*187*)
Copper sulfate (stabilizing agent)	2		1, 2, 5, 6	do	(*187*)
Movidyne	2		1, 2, 3, 4, 5, 6	do	(*187*)
Activated colloidal silver compound.	2		None	do	(*187*)
Calcium hypochlorite	2		2, 4, 5, 6	do	(*187*)
Sodium chloride	2		None	do	(*187*)
Disodium copper salt of ethylene	2		do	do	(*187*)
Diamine tetraacetic acid	2		do	do	(*187*)
Copper salt plus citrate	2		1, 2, 4, 5, 6	do	(*187*)
Copper naphthenate	2		2	do	(*187*)
Ziram	2		6	do	(*187*)
	2		1, 2, 3, 4, 5, 6	do	(*187*)
Disodium ethylene bis(dithiocarbamate).	2		6	Screening tests	(*187*)
PCP	2		None	do	(*187*)
NaPCP	2		do	do	(*187*)
p-chlorophenyl-p-chlorobenzenesulfamate.	2		do	do	(*187*)
Xanthic acid, ethyl sodium salt	2		do	do	(*187*)
Lauryl isoquinolinium bromide	2		3	do	(*187*)
Mercuric acetate	2		1, 2, 3, 4, 5, 6	do	(*187*)
Phenylmercuric hydroxide	2		1, 2, 3, 4, 5, 6	do	(*187*)
Phenylmercuric nitrate	2		1, 2, 3, 4, 5, 6	do	(*187*)
Acetic acid	2		None	do	(*187*)
4-chloro-o-toloxyacetic acid	2		do	do	(*187*)
2,4-D	2		do	do	(*187*)
Iodoacetic acid	2		2	do	(*187*)
2,4,5-T	2		None	do	(*187*)
3-nitro-4-acetoxybenzoic acid	2		do	do	(*187*)
3-nitro-4-hydroxybenzoic acid	2		do	do	(*187*)
3-nitro-4-methoxybenzoic acid	2		do	do	(*187*)
Terpine alcohol (85% pine oil)	2		do	do	(*187*)
di(p-chlorophenyl)methyl carbinol.	2		3, 5, 6	do	(*187*)
2,3-dichloronaphthoquinone	2		2, 6	do	(*187*)
Salicaldehyde	2		None	do	(*187*)
Vanillin	2		do	do	(*187*)
Dimethylaminobenzaldehyde	2		do	do	(*187*)
Tetrachlorophene	2		do	do	(*187*)
2-tertiary-butyl-4,6-dinitrophenol.	2		do	do	(*187*)
DNBP	2		do	do	(*187*)
Picric acid	2		do	do	(*187*)
BHC (α)	2		do	do	(*187*)
BHC (β)	2		do	do	(*187*)
BHC (δ)	2		do	do	(*187*)
BHC (γ)	2		do	do	(*187*)
Cumene hydroperoxide	2		do	do	(*187*)
DDT	2		do	do	(*187*)
2-benzoyl-1,3-dichloropropane	2		2, 4, 5, 6	do	(*187*)
Chlorinated camphene	2		2	do	(*187*)
Chlorinated benzene #1	2		2, 5, 6	do	(*187*)
Chlorinated benzene #2	2		2	do	(*187*)
Chlorinated benzene #3	2		2, 5, 6	do	(*187*)
Alkyl aryl bromide	2		2	do	(*187*)
Methyldodecylbenzyltrimethyl ammonium chloride.	2		None	do	(*187*)
Cetyldimethyl ammonium bromide.	2		do	do	(*187*)
Alkylate ether alcohol	2		do	do	(*187*)
DAC	2		3, 4, 5, 6	do	(*187*)

See footnotes at end of table, p. 31.

TABLE 4.—*Effects of certain aquatic herbicides on various algae*—Continued

1.—*Cylindrospermum lichenniforme*
2.—*Microcystis aeruginosa*
3.—*Scenedesmus obliquus*
4.—*Chlorella variegala*
5.—*Gomphonema parvulum*
6.—*Nitzschia palea*

[Species indicated by numbers in Control column]

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
	P.p.m.[1]				
High molecular alkyl-dimethyl ammonium chloride.	2		None	Screening tests	(*187*)
Mixed trimethyl and trimethyl octadecadienyl NH_4Cl.	2		do	do	(*187*)
Methyldodecylbenzyltrimethyl ammonium chloride plus tridecylmethylhydroxyethyl imidazolinium chloride.	2		do	do	(*187*)
Alpha naphthylamine	2		2	do	(*187*)
Beta naphthylamine	2		None	do	(*187*)
2,4-dinitrophenylhydrazine	2		do	do	(*187*)
Thiocarbamide	2		do	do	(*187*)
Monuron	2		2, 5, 6	do	(*187*)
Rosin amine D acetate	2		1, 2, 4, 5, 6	do	(*187*)
Rosin amine D sulfate	2		1, 2, 4, 5, 6	do	(*187*)
Diethanol rosin amine D acetate.	2		1, 2, 5, 6	do	(*187*)
Rosin amine D acetate (emulsifiable).	2		1, 2, 4, 5, 6	do	(*187*)
Rosin amine D pentachlorophenate (emulsifiable).	2		6	do	(*187*)
Sodium carboxyethyl rosin amine	2		None	do	(*187*)
Rosin amine D derivatives (emulsified).	2		5, 6	do	(*187*)
N(3-aminopropyl)rosin amine D diacetate.	2		2, 4, 5, 6	do	(*187*)
Acti-dione	2		3, 5, 6	do	(*187*)
Aerosporin-polymyxin β (sulfate)	2		2, 4, 5, 6	do	(*187*)
Penicillin G, potassium	2		2	do	(*187*)
Streptomycin sulfate	2		2	do	(*187*)
Terramycin	2		2	do	(*187*)
4,4-dichloro-alpha-methylbenzhydrol.	2		None	do	(*187*)
MISCELLANEOUS ALGAE SPECIES					
Chlorine (free)	100		Killed		(*176*)
Sulfur dioxide	100–1,000		do		(*176*)
Magnesium sulfate	4,000		do		(*176*)
Mercury	50		Inhibited	*Stigeoclonium, Chroococcus, Protococcus.*	(*176*)
Copper sulfate		5.4 lb		M.O. alkalinity greater than 50 p.p.m.; recommended rate.	(*169*)
	.3			M.O. alkalinity less than 50 p.p.m.; recommended rate.	(*169*)
Sodium arsenite	5–10			Recommended rate	(*169*)
Dichlone	.05			Blue-green. Recommended rate.	(*169*)
	.1		Satisfactory	Research trials (B.G.), Conn., N.J.	(*97*)
Simazine	6		Inhibited; checked growth several weeks.	*Chlorella, Oscillatoria, Phormidium.*	(*135*)

See footnotes at end of table, p. 31.

TABLE 4.—*Effects of certain aquatic herbicides on various algae*—Continued

VARIOUS FILAMENTOUS ALGAE SPECIES

Chemical	Concentration	Rate per acre [1]	Control or response	Remarks	Reference
	P.p.m.[1]				
Rosin amine D acetate	10		Killed; effective 2 miles.	Irrigation ditch, 15-minute contact.	(*158*)
	21		Killed; effective for 6 weeks.	Irrigation ditch, 20-minute contact.	(*158*)
Fermate	.5		90 percent	Tests in 2 ponds, N.Y	(*132*)
Dichlone	.1		None	Test in pond, N.Y	(*132*)
	.25		do	Test in 2 ponds, N.Y	(*132*)
Copper sulfate	.5		97 percent	Test in 6 ponds, N.Y	(*132*)
	1		100 percent	Test in 2 ponds, N.Y	(*132*)
Sodium arsenite	4		97 percent	Test in 3 ponds, N.Y	(*132*)
Delrad 50 S	.25		50 percent	Test in pond, N.Y	(*132*)
	.33		85 percent	Test in 4 ponds, N.Y	(*132*)
	.6		90 percent	Test in 9 ponds, N.Y	(*132*)

[1] Except as indicated.
[2] AUBURN UNIVERSITY. DATA ON CHEMICAL WEED CONTROL IN PONDS. Ala. Agr. Expt. Sta., Farm Ponds Proj., Unpublished Ann. Rpts. 1946–61.
[3] Personal correspondence on the use of RADA from R. F. Blanks, Bur. Reclam., Denver. 1950.

TABLE 5.—*Effects of dichlone on various algae*

Algae	Concentration	Control	Remarks	Reference
	μ g./l.			
Anabaena circinalis	5	100-percent kill	Screening tests	(*134*)
Aphanizomenon flos-aquae	5	do	do	(*134*)
Calothrix parietina	100	25-percent kill	do	(*134*)
Chlamydomonas	100	Ineffective	do	(*134*)
Chlorella pyrenoidosa	100	25-percent kill	do	(*134*)
Gloeocapsa alpicola	100	do	do	(*134*)
G. dimidiata	100	Ineffective	do	(*134*)
G. membranina	100	do	do	(*134*)
Gloeotrichia echinulata	5	100-percent kill	do	(*134*)
Lyngbya birgei	100	Ineffective	do	(*134*)
Microcystis aeruginosa	5	100-percent kill	do	(*134*)
M. incerta	5	do	do	(*134*)
M. marina (Anacystis marina)	10	do	do	(*134*)
Nostoc commune	100	90-percent kill	do	(*134*)
N. muscorum	100	Ineffective	do	(*134*)
Plectonema nostocorum	100	75-percent kill	do	(*134*)
Scenedesmus	100	95-percent kill	do	(*134*)
Stichococcus	100	50-percent kill	do	(*134*)
Stigeoclonium	100	Ineffective	do	(*134*)

TABLE 6.—*Effects of phenanthraquinone on various algae*

Species of algae	Concentration	Control	Remarks	Reference
	μ g./l.			
Anabaena circinalis	80	100-percent kill	Screening tests	(*134*)
Aphanizomenon flos-aquae	80	do	do	(*134*)
Calothrix parietina	80	90-percent kill	do	(*134*)
Chlorella pyrenoidosa	80	do	do	(*134*)
Coccochloris peniocystis	80	95-percent kill	do	(*134*)
Gloeocapsa alpicola	80	50-percent kill	do	(*134*)
G. dimidiata	80	Ineffective	do	(*134*)
G. membranina	80	do	do	(*134*)
Gloeotrichia echinulata	80	100-percent kill	do	(*134*)
Lyngbya birgei	80	Ineffective	do	(*134*)
Microcystis aeruginosa	80	95-percent kill	do	(*134*)
M. incerta	80	100-percent kill	do	(*134*)
M. marina (Anacystis marina)	80	do	do	(*134*)
Nostoc commune	80	Ineffective	do	(*134*)
N. muscorum	80	do	do	(*134*)
Plectonema nostocorum	80	50-percent kill	do	(*134*)

TABLE 7.—*Effects of copper sulfate on various algae*

Algae	Concentration	Control or response	Remarks	Reference
	P.p.m.			
Anabaena	0. 1	To kill	In lakes and ponds	(*177*)
Do	. 12	do	do	(*244*)
Do	0. 09–1	do	do	(*205*)
Do	. 06	53 percent in 5 days; 81 percent in 20 days.		(*128*)
Do	0. 10–0. 48	Good	In ponds or lakes	(*146*)
Do	. 09	do	do	(*238*)
Ankistrodesmus	0. 3–3	Reduced to killed		(*205*)
Do	1	For control	In ponds or lakes	(*244*)
Aphanizomenon	. 2	To kill	do	(*177*)
Do	0. 12–0. 5	do	do	(*244*)
Do	0. 12–0. 5	do	do	(*205*)
Do	1	do	In lakes and ponds (upper 3 feet of water).	(*199*)
Do	0. 12–0. 5	Good	In ponds or lakes	(*146*)
Asterionella	0. 1–1	Reduced to killed		(*205*)
Do	. 12	To kill	In lakes	(*177*)
Do	0. 12–0. 2	Satisfactory	In ponds	(*244*)
Do	0. 12–0. 2	Good	In ponds or lakes	(*146*)
Ceratinum	0. 24–0. 33	Killed	do	(*146*)
Chlamydomonas	1	To kill	do	(*177*)
Do	0. 5–1	do	do	(*205*)
Do	0. 36–1	do	do	(*146*)
Clathrocystis	0. 12–0. 25	For control	do	(*244*)
Do	0. 12–0. 25	Good	do	(*146*)
Closterium	. 15	To kill	In lakes	(*177*)
Do	. 17	Good	In ponds	(*146*)
Do	. 17	For control	In ponds or lakes	(*244*)
Coelastrum	0. 05–0. 33	Good	In ponds	(*146*)
Do	0. 05–0. 33	For control	In ponds or lakes	(*244*)
Coelosphaerium	. 3	Reduced to killed		(*205*)
Do	. 3	To kill	In lakes	(*177*)
Do	0. 2–0. 33	For control	In ponds or lakes	(*244*)
Do	0. 2–0. 33	Good	do	(*146*)
Conferva	. 25	do	In ponds	(*146*)
Do	0. 4–2	do	In ponds or lakes	(*238*)
Cryptomonas	. 5	Killed	In ponds	(*146*)
Cylindrospermum	. 12	Good	In ponds or lakes	(*146*)
Desmidium	2	To kill	In lakes	(*177*)
Do	2	For control	In ponds or lakes	(*244*)
Do	2	Good	In ponds	(*146*)
Dinobryon	. 18	Killed	Pond or lake tests	(*146*)
Draparnaldia	. 3	To kill	In lakes	(*177*)
Do	. 33	For control	In ponds or lakes	(*244*)
Do	. 33	Good	In ponds	(*146*)
Entermorpha	. 5	For control	In ponds or lakes	(*244*)
Do	. 5	Good	do	(*146*)
Eudorina	10	To kill	In lakes	(*177*)
Do	10	For control	In ponds or lakes	(*244*)
Do	2–10	Good	In ponds	(*146*)
Euglena	. 7	To kill	In lakes	(*177*)
Do	. 5	do	In ponds or lakes	(*146*)
Fragilaria	. 25	do	In lakes	(*177*)
Do	. 06	27 percent in 5 days; 78 percent in 20 days.		(*128*)
Do	. 25	Satisfactory	In ponds	(*244*)
Do	. 25	Good	do	(*146*)
Do	0. 25–1. 25	Reduced to killed		(*205*)
Glenodinium	. 5	Killed	Ponds or lakes	(*146*)
Gloeocapsa	. 24	Good	do	(*146*)
Gleocystis	. 5	do	do	(*146*)
Lynbya	. 06	36 percent in 5 days; 52 percent in 20 days.		(*128*)
Mallomonas	. 5	Killed	Pond or lake tests	(*146*)
Melosira	. 33	Satisfactory	In ponds	(*244*)
Do	. 2	Good	do	(*146*)

TABLE 7.—*Effects of copper sulfate on various algae*—Continued

Algae	Concentration	Control or response	Remarks	Reference
	P.p.m.			
Microcystis	.1	To kill	In lakes and ponds	(*177*)
Do	.2	do	do	(*244*)
Do	.06	49 percent in 5 days; 44 percent in 20 days.		(*128*)
Do	.2	Good	In ponds or lakes	(*146*)
Microspora	.4	For control	do	(*244*)
Do	.4	Good	do	(*146*)
Navicula	.07	Satisfactory	In ponds	(*244*)
Do	.07	Good	do	(*146*)
Do	.07	do	In ponds or lakes	(*238*)
Nitzschia	.5	Good	In ponds	(*146*)
Oscillatoria	0.1–0.5	Reduced to killed		(*205*)
Do	1.5	Satisfactory	Research trials, N.J	(*97*)
Do	.2	To kill	In lakes	(*177*)
Do	0.2–0.5	For control	In ponds or lakes	(*244*)
Do	0.2–0.5	Good	do	(*146*)
Do	0.1–0.4	do	do	(*238*)
Palmella	2	For control	do	(*244*)
Do	2	Good	do	(*146*)
Pandorina	10	To kill	In lakes	(*177*)
Do	.06	57 percent in 5 days; 45 percent in 20 days.	do	(*128*)
Do	10	For control	In ponds or lakes	(*244*)
Do	2–10	Good	do	(*146*)
Pediastrum	.06	52 percent in 5 days; 71 percent in 20 days.		(*128*)
Peridinium	.5	To kill	In lakes	(*177*)
Do	0.5–2	do	In ponds or lakes	(*146*)
Porphyridium	1–1.5	Satisfactory	Research trials, N.J	(*97*)
Raphidium	1	Good	In ponds or lakes	(*146*)
Scenedesmus	0.3–5	Reduced to killed		(*205*)
Do	1	To kill	In lakes	(*177*)
Do	1	Satisfactory	In lakes or ponds	(*244*)
Do	1	Good	do	(*146*)
Do	5–10	do	do	(*238*)
Spirogyra dubia	Trace (from penny)	Killed	Aquaria	(*176*)
Spirogyra nitida	Trace (from penny)	do	do	(*176*)
Staurastrum	1.4	Reduced to killed		(*205*)
Do	.06	29 percent in 5 days; 60 percent in 20 days.		(*128*)
Do	1.5	Satisfactory	In ponds	(*244*)
Do	1.5	Good	In ponds or lakes	(*146*)
Stephanodiscus	.33	Satisfactory	In ponds	(*244*)
Do	.33	Good	do	(*146*)
Synedra	2	To kill	In lakes	(*177*)
Do	0.3–1.66	Reduced to killed		(*205*)
Do	.50	Satisfactory	In ponds	(*244*)
Do	0.36–0.5	Good	do	(*146*)
Synura	.3	To kill	In lakes	(*177*)
Do	0.12–0.25	do	In ponds or lakes	(*146*)
Tabellaria	2	do	In lakes	(*177*)
Do	0.12–0.5	Satisfactory	In ponds	(*244*)
Do	0.12–0.5	Good	do	(*146*)
Tribonema	.25	Satisfactory	do	(*244*)
Tribonema utriculata	.5	do	Research trials, N.J	(*97*)
Uroglena	.05	To kill	In lakes	(*177*)
Do	0.05–0.2	do	In ponds or lakes	(*146*)
Volvox	.3	do	59° F	(*245*)
Do	.25	do	In lakes	(*177*)
Do	.25	Satisfactory	In ponds	(*244*)
Do	.25	Good	In ponds or lakes	(*146*)
Do	.25	do	do	(*238*)

TABLE 8.—*Effects of chlorine on various algae*

Algae	Concentration	Control	Remarks	Reference
	p.p.m.			
Anabaena	0. 5–1	Good	In ponds or lakes	(*146*)
Aphanizomenon	0. 5–1	do	do	(*146*)
Asterionella	0. 5–1	do	do	(*146*)
Clathrocystis	0. 5–1	do	do	(*146*)
Coelastrum	1	do	do	(*146*)
Coelosphaerium	0. 5–1	do	do	(*146*)
Cyclotella	1	do	do	(*146*)
Dictyosphaerium	0. 5–1	do	do	(*146*)
Melosira	2	do	do	(*146*)
Oscillatoria	1. 1	do	do	(*146*)
Protococcus	1	do	do	(*146*)
Spirogyra	0. 7–1. 5	do	do	(*146*)
Synedra	1	do	do	(*146*)
Tabellaria	0. 5–1	do	do	(*146*)
Tetrastrum	1	do	do	(*146*)
Volvox	0. 3–1	do	do	(*146*)

Effects of Aquatic Herbicides on Various Weeds

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
		Cabomba caroliniana (Fanwort)				
	P.p.m.[1]					
2,4-D		100 lb	Granules		20-percent granular form; recommended rate.	(*197*)
2,4-D, IOE		20 lb	do	95 percent	Broadcast application, pond tests, Ga.	(*236*)
2,4,5-T	3			Some kill	Dewatered after treatment	(2)
Silvex	1–2			Satisfactory	Pond tests, N.J	(*97*)
	.5			Unsatisfactory	Pond tests, spray, N.J	(*97*)
Monuron		50 lb		Resistant	Pond tests, N.J	(*159*)
		75 lb		do	do	(*159*)
		100 lb		do	do	(*159*)
Erbon	2			Unsatisfactory	Pond tests, spraying, N.J	(*97*)
	2–2.5			Killed	Pond tests, 21 days	(*251*)
Dichlone	.75	2 lb./acre-ft			Trial use suggested	(*169*)
Copper sulfate		400 lb		Resistant	Pond tests, N.J	(*159*)
		500 lb		do	do	(*159*)
Sodium arsenite	8			100 percent	Pond tests, 3 months	(2)
	8			None	High iron content in pond water.	(2)
Disodium versenate	500			Killed	Aquaria tests, N.J., gave pH 3.8 in water.	(*159*)
Zinc disodium versenate	500			do	do	(*159*)
Copper disodium versenate	500			do	do	(*159*)
Versene acid	500			do	do	(*159*)
Acetic acid	To give pH 3.8			do	Aquaria tests, N.J	(*159*)
		Callitriche spp. (Water-starworts)				
Delrad 70	4			Fair to good	Pond tests, Oreg	(*109*)
		Ceratophyllum demersum (Coontail)				
2,4-D, Dowanol ester		20 lb	Granules	20 percent	Lake water, pH 9.1–9.3	(*211*)
		20 lb	do	100 percent	Lake water, pH 5.3	(*211*)
2,4-D, isopropanolamine		40 lb	Granules	Ineffective	Pond tests	(*141*)
2,4-D, acid		10, 20, 40 lb	do	None	Plant full grown, Ark	(*211*)
2,4-D, acetamide		10 lb	do	40 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	70 percent	do	(*248*)
		40 lb	do	80 percent	do	(*248*)
2,4-D (P)	10–20			Good	4-week tests, Mich	(*144*)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Ceratophyllum demersum (Coontail)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.[1]					
2,4-D	5			100 percent	Greenhouse tests, 14 days	(*198*)
	10			do	Greenhouse tests, 11 days	(*198*)
2,4-D, BEE		10 to 15 lb	Granules	None	Stagnant water in ditch, Ark.	(*211*)
		10 lb	do	100 percent	Treated May 26, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	do	do	(*248*)
		40 lb	do	do	do	(*248*)
2,4-D, IOE		20 lb	Granules	100 percent	Lake water, pH 5.3	(*211*)
		30 lb	do	do	do	(*211*)
		20 lb	do	No kill	Lake test, N.J	(*160*)
2,4,5-T	3			Complete kill	Pond test, Ala., 30 days	([2])
2,4,5-T, DMS		10 lb	Granules	30 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	70 percent	do	(*248*)
		40 lb	do	90 percent	do	(*248*)
Silvex	.8			80 percent	Pond test	(*123*)
		10 lb	Granules	50 percent	Treated June 5, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	60 percent	do	(*248*)
		40 lb	do	80 percent	do	(*248*)
	2			Satisfactory	Research trials, spray, N.J	(*97*)
	5			Poor	10-day exposure, jars, Oreg	(*110*)
	10			Poor to fair	do	(*110*)
Silvex, Na salt, acid, PGBEE		20 lb	Granules	20 percent	Lake water, pH 9.1–9.3	(*211*)
		20 lb	do	100 percent	Lake water, pH 5.3	(*211*)
Silvex, IOE	2			Good	3 pond tests	(*148*)
Monuron + TCA		10, 20, 40 lb	Granules	None	Plant full grown, Ark	(*211*)
Monuron		10 lb	do	30 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	50 percent	do	(*248*)
		40 lb	do	60 percent	do	(*248*)
		50 lb		Resistant	Pond tests, N.J	(*159*)
		100 lb		do	do	(*159*)
		125 lb		do	do	(*159*)
Diuron		10 lb	Granules	None	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	do	do	(*248*)
		40 lb	do	do	do	(*248*)
2,4,5-TCB	10–15	15 to 25 gal		Effective kill		(*149*)
Endothal		10, 20, 40 lb	Granules	None	Plant full grown, Ark	(*211*)
DCB	20–80	30 gal		Excellent kill		(*149*)
Amitrole		10 lb	Granules	20 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	40 percent	do	(*248*)
		40 lb	do	70 percent	do	(*248*)

Ebron	5			Good	10-day exposure, jars, Oreg	(110)
	10			100 percent	do	(110)
Simazine		10 lb	Granules	10 percent	Treated July 18, checked Sept. 18, drainage ditch, Ark.	(248)
		20 lb	do	30 percent	do	(248)
		40 lb	do	50 percent	do	(248)
Dichlone		10 lb		Some initial kill; regrowth in all plots.	Pond tests, N.J	(159)
		15 lb		do	do	(159)
		16 lb		do	do	(159)
		32 lb		do	do	(159)
		40 lb		do	do	(159)
Aromatics	.75	2 lb/acre-ft			Trial use suggested	(169)
	300			Satisfactory	Irrigation channels, 30-minute contact.	(239)
Copper sulfate		300 lb		Resistant	Pond tests, N.J., 8 percent maximum area of pond treated at one time.	(159)
$KMnO_4$	15–20			Good kill	Wet bottom, Ala	(2)
Sodium arsenite	10			100 percent	Greenhouse tests, 10 days	(198)
	3–10			Satisfactory	Research trials, Del., N.J	(97)
	4–8			Good kill		(149)
	1.7–2			Killed	Pond tests	(229)
	8			Eradicated	Pond tests, Ala., 3 months	(2)
	2.7–4				Recommended rate	(188)
	4–5				Pond in Israel; recommended rate.	(201)
	1–1.7			Successful	Ponds in Ohio	(227)
	8			None	High iron content in pond water.	(2)
Delrad	12			Only partial	Pond tests, N.J.; slight fish kill.	(159)
2,4-DEP		3.3 lb	Granules	None	Plant full grown, Ark	(211)
		6.7 lb	do	do	do	(211)
		13.3 lb	do	do	do	(211)
CDEA		10, 20, 40 lb	Granules	None	Plant full grown, Ark	(211)
		10, 20, 40 lb	do	do	do	(211)
CIPC		10 lb	Granules	20 percent	Treated July 18, checked Sept. 18, drainage ditch, Ark.	(248)
		20 lb	do	40 percent	do	(248)
		40 lb	do	60 percent	do	(248)
PBA, dimethylamine		10 lb	Granules	70 percent	Treated June 5, checked Sept. 18, drainage ditch, Ark.	(248)
		20 lb	do	100 percent	do	(248)
		40 lb	do	do	do	(248)
2,3,6 TBA, sodium salt		10 lb	Granules	60 percent	Treated June 5, checked Sept. 18, drainage ditch, Ark.	(248)
		20 lb	do	70 percent	do	(248)
		40 lb	do	90 percent	do	(248)
Disodium versenate	500			Killed	Pond tests, N.J.; gave pH 3.8 in water.	(159)
Zinc disodium versenate	500			do	do	(159)
Copper disodium versenate	500			do	do	(159)
Versene acid	500			do	do	(159)
Acetic acid	To give pH 3.8			do	Tests in N.J	(159)
Hyman P–162	4.5			Good	Pond tests, Oreg	(109)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Eleocharis acicularis (Needlerush)

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.[1]					
2,4-D, amine		3 lb	Water (1:80)	50 percent; 100-percent regrowth same year.	Spray application, Mar. 9, 1959, pond test, Ga.	(*235*)
	2		Water (13:40)	None; 100-percent survival.	Spray application, Aug. 27, 1959, pond test, Ga.	(*235*)
2,4-D, BE		4 to 8 lb	Diesel fuel	Excellent	Dewatered pond area	(2)
2,4-D, IOE		40 lb	Granules	None	Plants on moist bank and in water, Auburn, Ala.	(2)
		160 lb	do	No effect in 1 year	Ga	(*211*)
2,4-D, IPE		4 lb	Diesel fuel	Effective	Sprayed on dewatered pond area.	(2)
		6 to 8 lb	do	Excellent	Dewatered pond area	(2)
		2 to 4 lb	do	Fair to good	do	(2)
2,4-D, NH_4 salt		8 lb	Water	Good kill	Sprayed on dewatered pond area.	(2)
2,4-D, Na salt		8 lb	do	do	do	(2)
2,4,5-T	3			Partial kill	Dewatered after treatment in ponds.	(2)
Silvex	2			50 percent	Gravity-flow application, pond tests, Ga.	(*236*)
	1			100 percent	Spray application, pond tests, Ga.	(*236*)
		20 lb	Clay granules	do	Broadcast application, Mar. 30, 1959, pond tests, Ga.	(*235*)
	1		Water (1:20)	do	Spray application, Mar. 30, 1959, pond tests, Ga.	(*235*)
	3		Water (1:10)	do	Spray application, July 22, 1959, pond tests, Ga.	(*235*)
Silvex, PGBEE	.25			100 percent	Plants on bank and in water, pond tests, Ga.	(*211*)
	.5			do	do	(*211*)
	2.			do	do	(*211*)
	3.			do	do	(*211*)
TCA+2,4-D, Na salt		4 lb. + 8 lb		No effect	Dewatered pond area	(2)
		4 lb.+8 lb		Good kill	do	(2)
		16 lb. + 16 lb		No effect	do	(2)
		16 lb.+16 lb		Good kill	do	(2)
TCA+2,4,5-T		8 lb.+8 lb		No effect	Dewatered pond tests	(2)
		8 lb.+8 lb		Good kill	do	(2)
Dalapon		10 lb		Resistant	do	(*210*)
Monuron		75 lb		do	Pond tests, N.J	(*159*)
		100 lb		do	do	(*159*)
Diuron		75 lb	Water	Eliminated for 1 year	Sprayed on dewatered pond area.	(2)
		75 lb	do	Good	Dewatered pond bottom, 1 year.	(*210*)
Simazine		40 lb	Granules	None	Plants on moist bank and in water, Ala.	(2)

Copper sulfate		400 lb		Resistant	Pond tests, N.J., 87 percent maximum area treated at one time.	(159)
		500 lb		do	do	(159)
Sodium arsenite	6–8			100 percent	Gravity-flow application, pond tests, Ga.	(236)
	4			60 percent; 100-percent regrowth same year.	Gravity-flow application, Mar. 9, 1959, pond tests, Ga.	(235)
	6			100 percent; no regrowth same year.	Gravity-flow application, Apr. 16, 1959, pond tests, Ga.	(235)
Chlorea		2,000 lb	Granules	10 percent	Broadcast application, pond tests, Ga.	(236)
Eleocharis cellulosa (Needlerush)						
2,4-D, PGBEE		20 lb	Granules	80 percent	Lake margin, water 0–4 feet deep.	(211)
Dalapon + silvex, PGBEE		48 lb.+6 lb		90 percent	do	(211)
Simazine		20 lb	Granules	None	do	(211)
Eleocharis parvula (Spikerush)						
2,4-D, IOE		20 lb	Granules	20 percent	Applied to dewatered pond, Ala.	(211)
		30 lb	do	30 percent	do	(211)
2,4-D, IPE		4 lb	Oil	100 percent	Pond tests, Ala	(211)
Simazine		2.4 lb	Granules	None	Dewatered pond, Ala	(211)
		8 lb	Water	70 percent	do	(211)
		32 lb	do	100 percent	do	(211)
Elodea canadensis (*Anacharis canadensis*) (Elodea)						
2,4-D		100 lb			Recommended rate	(197)
2,4-D, ester	10			None	Pond tests, N.J	(159)
	15			do	do	(159)
	20			do	do	(159)
	25			do	do	(159)
2,4-D	25			Ineffective	Greenhouse tests, 56 days	(198)
	50			do	do	(198)
2,4-D, TEA	5			Killed	Aquaria tests	(234)
2,4-D, TBP		10 lb		Arrested growth	Pond tests	(234)
	10			Killed	Aquaria tests	(234)
	5			do	do	(234)
2,4-D, IOE		86 lb	Granules	None	Broadcast application, pond tests, Ga.	(236)
		86 lb	do	do	do	(236)
		86 to 172 lb	do	do	Pond tests, Ga	(171)
2,4-D, IPE	5		Emulsifier	Good kill; death in 6 days, regrowth in 2 months.		(185)
MCPA	10			Killed	Aquaria tests	(234)
2,4,5-T, TBP	10			do	do	(234)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Elodea canadensis (*Anacharis canadensis*) (Elodea)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.[1]					
Silvex	2			Fair	10-day exposure, jars	(*110*)
	5			100 percent	do	(*110*)
	1			Satisfactory	Field trials, N.J	(*97*)
	2			30 percent	Pond tests, 6 weeks	([2])
	5			100 percent; plants killed in 4 weeks, no regrowth within 6 months.		([2])
	2		Granules	None	Pond tests, N.Y	(*171*)
	2			do	Gravity-flow application, pond tests, Ga.	(*236*)
		16 lb	Water, 80 gals	do	Spray application, pond tests, Ga.	(*236*)
Silvex, PGBEE	.1			90–100 percent	Pond tests, N.J	(*252*)
	1			95–100 percent	do	(*252*)
	2			do	do	(*252*)
	3			do	do	(*252*)
	3.5			do	do	(*252*)
	1			Good	Pond tests, treated May 29, 1960.	(*148*)
	.5			None	Pond test, N.Y	(*171*)
	.75			100 percent	do	(*171*)
	0.5–2.5			Good	do	(*171*)
Silvex, IOE	2			Killed	4 pond tests	(*148*)
IPC	10			Arrested growth, no kill.	Aquaria tests	(*234*)
Monuron	10			Killed	Pond tests, Oreg	(*109*)
	4.6	25 lb		Poor	Pond tests, N.J	(*159*)
	9.2	50 lb		Partial	do	(*159*)
	15.4	100 lb		do	do	(*159*)
Diuron	5			Killed	Pond tests, Oreg	(*109*)
	10			do	do	(*109*)
Endothal	80			None killed	Cuttings, 30-minute contact	(*102*)
	240			do	do	(*102*)
	400			do	do	(*102*)
	2			Good; regrowth same year.	Test in lake in Wis	(*171*)
Erbon	5			Good	10-day exposure, jars	(*110*)
	10			100 percent	do	(*110*)
	1			Killed	Pond tests, 21 days	(*251*)
AMS	10			No effect	Aquaria tests	(*234*)
Dichlone	.75	2 lb./acre-ft			Trial use suggested	(*169*)
Aromatics	300			Satisfactory	Irrigation channels, 30-minute contact.	(*239*)

Aromatic solvent	400	5.4–5.9 gal./c.f.s		Good for 5–6 weeks; killed ¾ to 1½ miles below.	Irrigation channels	(*117*)
	600	8.1 gal./c.f.s		Good for 8 weeks; killed ¾ to 1½ miles below.	do	(*117*)
	740	10 gal./c.f.s		Good for 8 weeks; killed up to 5 miles below.	do	(*117*)
Benoclor 3C		20 gal		Fair kill	Spot treatment from bank	(*185*)
		750 gal./35 acres + 700 gal./25 acres.		Satisfactory	Tests in N.Y	(*246*)
	300				Irrigation ditch, 1-hour exposure.	(*125*)
Copper sulfate		400 lb		90 percent	Pond tests, N.J.; 8-percent maximum area treated at one time.	(*159*)
Sodium arsenite	2. 5–4				Ponds; recommended rate	(*188*)
	2. 5–4				do	(*232*)
	1–1. 7			Successful	Pond tests, Ohio	(*227*)
	4			Killed	Pond tests, Oreg	(*109*)
	1. 7–2			Hard to kill	Pond tests	(*230*)
	2. 5			Good kill	do	(*230*)
	10			100 percent	Greenhouse tests, 13 days	(*198*)
	3			Satisfactory	Field trials, Del	(*97*)
	10–12			Poor	Lake tests, S. Dak	(*171*)
	4(As_2O_3)			100 percent	Gravity-flow application, pond tests, Ga.	(*236*)
	2(As_2O_3)			do	do	(*236*)
	2(As_2O_3)			do	do	(*236*)
Ammonium thiocyanate	100			100 percent	Greenhouse tests, 13 days	(*198*)
Chlorea		430 lb	Granules	None	Broadcast application, pond tests, Ga.	(*236*)
Elodea densa (*Anacharis densa*) (Dense waterweed)						
m-acetylbiphenyl	25			Complete	14-day exposure, 5-gal. glass jars. Preliminary evaluation tests.	(*108*)
Acriflavine	25			do	do	(*108*)
Allyl-β-naphthyl carbamate	25			do	do	(*108*)
9-amino acridine	25			do	do	(*108*)
2-aminoanthraquinone	25			do	do	(*108*)
2-amino-5-diethyl aminotoluene monohydrochloride.	25			do	do	(*108*)
p-aminodimethyl aniline monohydrochloride.	25			do	do	(*108*)
Anisic acid	33			do	do	(*108*)
Aromatic #80 plus 5% Tenlo-400.	100			do	do	(*108*)
Azoxybenzene	25			do	do	(*108*)
Azoxybenzene plus 1% copper chloride.	10			do	do	(*108*)
p-benzalaminophenol	50			do	do	(*108*)
5-benzal rhodamine	25			do	do	(*108*)
Benzene hexachloride	50			do	do	(*108*)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Elodea densa (*Anacharis densa*) (Dense waterweed)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.[1]					
Benzidinebis (O-isopropyl carbamate).	25			Complete	14-day exposure, 5 gal. glass jars. Preliminary evaluation tests.	(*108*)
Benzophenone	100			do	do	(*108*)
β-benzoylacrylic acid	25			do	do	(*108*)
p-benzylaminophenol	20			do	do	(*108*)
o-benzylphenol	25			do	do	(*108*)
p-benzylphenol	25			do	do	(*108*)
Boric acid	200			do	do	(*108*)
p-bromophenacyl bromide	25			do	do	(*108*)
n-butyl-p-toluene sulfonate	100			do	do	(*108*)
Calcium 2,4-dichlorophenoxyacetate.	100			do	do	(*108*)
Camphene	15			do	do	(*108*)
Camphene plus 1% copper chloride.	10			do	do	(*108*)
Carbazole	50			do	do	(*108*)
Chlorinated m-phenylacetophenone.	25			do	do	(*108*)
p-chloroacetophenone	50			do	do	(*108*)
p-chloroacetophenone with copper 2,4-dichlorophenoxyacetate.	5			do	do	(*108*)
2-chloro-4-aminobenzoic acid	25			do	do	(*108*)
m-chlorobenzoic acid	100			do	do	(*108*)
p-chlorobromobenzene	50			do	do	(*108*)
3-chloroisopropyl-N-carbamate	50			do	do	(*108*)
α-chloromethylnaphthalene	50			do	do	(*108*)
4-chloro-3-methyl-2-nitrophenol	25			do	do	(*108*)
α-chloronaphthalene	50			do	do	(*108*)
p-chlorotoluene	50			do	do	(*108*)
Copper 2-aceto-1-naphthate	10			do	do	(*108*)
Copper acetyl-o-aminobenzoate	10			do	do	(*108*)
Copper acetyl-p-aminobenzoate	10			do	do	(*108*)
Copper acetyl-o-aminophenate	5			do	do	(*108*)
Copper acetyl-p-methylaminophenate.	5			do	do	(*108*)
Copper 2-amino-3,5-diiodobenzoate.	5			do	do	(*108*)
Copper o-aminophenol-p-sulfonate.	5			do	do	(*108*)
Copper 4-aminotoluene-3-sulfonate.	5			do	do	(*108*)
Copper aniline disulfonate	5			do	do	(*108*)
Copper benzoate	5			do	do	(*108*)
Copper d-camphenate	5			do	do	(*108*)
Copper chloride	.3			do	do	(*108*)
Copper N-2 chlorophenol phthalamate.	5			do	do	(*108*)

Copper o-chlorophenoxyacetate	5			do	do	(108)
Copper p-chlorophenoxyacetate	10			do	do	(108)
Copper 4,4′-diaminostilbene	5			do	do	(108)
Copper dichloracetate	5			do	do	(108)
Copper 2,4-dichlorobenzoate	10			do	do	(108)
Copper 2,4-dichlorophenoxyacetate.	4			do	do	(108)
Copper 3,5-dinitrobenzoate	5			do	do	(108)
Copper diphenyl acetate	25			do	do	(108)
Copper diphenyl-p-p′-disulfonate.	10			do	do	(108)
Copper p-fluorobenzoate	5			do	do	(108)
Copper idosobenzoate	5			do	do	(108)
Copper p-iodobenzoate	5			do	do	(108)
Copper isobutoxide	5			do	do	(108)
Copper maleate	2			do	do	(108)
Copper MCPA	25			do	do	(108)
Copper methoxide	10			do	do	(108)
Copper 2-methyl-4-chlorophenoxyacetate.	5			do	do	(108)
Copper monochloroacetate	10			do	do	(108)
Copper α-naphthalene acetate	5			do	do	(108)
Copper nitrate	5			do	do	(108)
Copper p-nitrophenylacetate	10			do	do	(108)
Copper pentachlorophenate	1			do	do	(108)
Copper phenoxyacetate	3			do	do	(108)
Copper phenylacetate	10			do	do	(108)
Copper sulfate	5			do	do	(108)
Copper trichloroacetate	10			do	do	(108)
Copper 2,4,6-trinitrophenate	5			do	do	(108)
9,10-dibromo anthracene	25			do	do	(108)
Dibromo barbituric acid	25			do	do	(108)
4,4-dibromodiphenyl	25			do	do	(108)
2,4-dibromophenol	25			do	do	(108)
2,5-dibromotoluene	33			do	do	(108)
Dichloroamine	33			do	do	(108)
p-dichlorobenzene	100			do	do	(108)
3,4-dichlorobenzene	25			do	do	(108)
p-dichlorobenzene with phenoxyacetic acid.	20			do	do	(108)
3,4-dichloronitrobenzene	15			do	do	(108)
2,6-dichloro nitrophenyl	25			do	do	(108)
2,4-dichlorophenoxyacetic acid with copper nitrate.	5			do	do	(108)
Do	5+trace			do	do	(108)
2,4-dichloroquinone	25			do	do	(108)
3,5-diiodo-4-hydroxybenzoic acid.	33			do	do	(108)
2,3-dimethoxybenzaldehyde-2,4-dinitrophenylhydrazone.	25			do	do	(108)
p-dimethylaminobenzaldehyde-2,4-dinitrophenylhydrazone.	25			do	do	(108)
3,3-dimethylbenzidinebis-(O-isopropyl carbamate).	25			do	do	(108)
Dimethylchloro fumarate	25			do	do	(108)
Dinitro-o-isopropyl phenol	25			do	do	(108)
2,4-dinitrophenylhydrazine	6			do	do	(108)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Elodea densa (*Anacharis densa*) (Dense waterweed)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.[1]					
Diphenylacetic acid	50			Complete	14-day exposure, 5-gal. glass jars. Preliminary evaluation tests.	(*108*)
Diphenylamine	50			do	do	(*108*)
Diphenylamine hydrochloride	20			do	do	(*108*)
Diphenylcarbamine chloride	10			do	do	(*108*)
1,3-diphenyl guanidine	25			do	do	(*108*)
Dupanal C	50			do	do	(*108*)
Ethyl benzene sulfonate	100			do	do	(*108*)
Fluorone	33			do	do	(*108*)
Fumaronitrile	25			do	do	(*108*)
1,1,1,2,2,3,3-heptachloro propane.	25			do	do	(*108*)
p-hydroxy diphenyl	25			do	do	(*108*)
Iodosbenzoic acid	33			do	do	(*108*)
Menadione	25			do	do	(*108*)
Mercuric bromide	25			do	do	(*108*)
p-methoxybenzophenone-2,4-dinitrophenylhydrazone.	25			do	do	(*108*)
Metoquinone	25			do	do	(*108*)
Naphthalene	50			do	do	(*108*)
α-naphthalene acetamide	25			do	do	(*108*)
β-naphthol	33			do	do	(*108*)
β-naphthylamine	33			do	do	(*108*)
o-nitrobenzoic acid	26			do	do	(*108*)
p-nitrobenzoic acid	25			do	do	(*108*)
p-nitrobenzoylchloride	33			do	do	(*108*)
Nitroso-β-naphthol	25			do	do	(*108*)
Pentachlorophenoxy acetic acid	25			do	do	(*108*)
Phenoxyacetic acid	50			do	do	(*108*)
Phenoxyacetic acid (99.1% plus 1% $CuCl_2$).	10			do	do	(*108*)
Pinene	50			do	do	(*108*)
1-[2-(t-dodecylmercapto) ethyl] pyridium chloride.	25			do	do	(*108*)
Sodium hypochlorite	100			do	do	(*108*)
NaPCP	25			do	do	(*108*)
T-97 (Julius Hyman compound).	20–25			do	do	(*108*)
T-98 (Julius Hyman compound).	20–25			do	do	(*108*)
T-99 (Julius Hyman compound).	20–25			do	do	(*108*)
T-106 (Julius Hyman compound).	20–25			do	do	(*108*)
2,4,5-T	25			do	do	(*108*)
Tetraethyldiaminobenzophenone-2,4-dinitrophenylhydrazone.	25			do	do	(*108*)

p-thiocresyl	25			do	do	(108)
2,4,6-triaminobenzoic acid hydrochloride.	50			do	do	(108)
Trichloroacetanilide	25			do	do	(108)
1,2,4-trichlorobenzone	50			do	do	(108)
2,4-6-trichloro phenol	25			do	do	(108)
(Alkylbenzyl) trimethyl ammonium chloride.	25			do	do	(108)
Turpentine	10			do	do	(108)
Zinc 4-aminotoluene-3-sulfonate.	10			do	do	(108)
Zinc benzoate	10			do	do	(108)
Zinc d-camphenate	10			do	do	(108)
Zinz 5-chloro-2-aminobenzoate	10			do	do	(108)
Zinc p-chlorophenoxy acetate	10			do	do	(108)
Zinc 2,4-dichlorobenzoate	10			do	do	(108)
Zinc 2,4-dichlorophenoxyacetate.	5			do	do	(108)
Zinc pentachlorophenate	5			do	do	(108)
Zinc phenoxyacetate	10			do	do	(108)
2,4-D	10			do	Pond tests, Oreg	(108)
MCPA Copper salt	4			Good; killed to mudline, regrowth after several months.	Pond test	(108)
Silvex, PGBEE	2			Fair	Laboratory tests, Oreg	(171)
	5			Good	do	(171)
Monuron	49.7		Granules	None	Greenhouse tests, 10 months	(181)
	40			do	Pond tests, Oreg	(108)
	5			do	Glass-jar tests, 21 days, La	(150)
	10			do	do	(150)
	100			do	do	(150)
Diuron	5			7–10 percent	Glass-jar tests, 14–21 days, La	(150)
	10			0–7 percent	do	(150)
	100			43–80 percent	do	(150)
Trichlorobenzene	50			Effective; killed to mudline, regrowth after several months.	Pond test	(108)
	25			Ineffective	do	(108)
Endothal	80			None	Excised plants, 30-minute contact, 5 weeks to 3 months.	(181)
	240			do	do	(181)
	400			do	do	(181)
Copper sulfate	10			Poor	Tests, Oreg	(171)
	5			Effective	Pond test	(108)
Sodium arsenite	20			Top kill	Pond tests, Oreg	(108)
	Less than 20			Poor to partial	do	(108)
Delrad	1			53–55 percent	Glass-jar tests, 14–21 days, La	(150)
	5			95–100 percent	do	(150)
	10			100 percent	do	(150)
	10			Effective; killed to mudline, regrowth after several months.	Pond test	(108)
	4			Ineffective	do	(108)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Elodea densa (*Anacharis densa*) (Dedse waterweed)—Continued						
	P.p.m.[1]					
Delrad (granular)	5			60-percent kill	Pond tests, Oreg	(*109*)
	10			85-percent kill; killed to mudline.	do	(*109*)
	8			Partial kill	do	(*109*)
CIPC	5			None	Glass-jar tests, 21 days, La	(*150*)
	10			do	do	(*150*)
	100			100 percent	Glass-jar tests, 14–21 days, La	(*150*)
Acetic acid	To give pH 3.8			Killed	Tests, N.J	(*159*)
Versene acid	500			do	Pond tests, N.J., gave pH 3.8	(*159*)
Disodium versenate	500			do	do	(*159*)
Zinc disodium versenate	500			do	do	(*159*)
Copper disodium versenate	500			do	do	(*159*)
Phenoxyacetic acid	15			Top kill only	Pond tests, Oreg	(*108*)
Naphthalene	15			None	do	(*108*)
Phenoxyacetic acid + 1% CuCl	40			Top kill	do	(*108*)
Hyamine 1622	3			Good top kill	do	(*108*)
Hexachlorocyclopentadiene	5–10			Effective; killed to mudline.	do	(*108*)
	1			Ineffective	do	(*108*)
Socal #2	300			Effective; killed to mudline, regrowth after several months.	Pond tests, Oreg	(*108*)
Turpentine	15			Top kill only	do	(*108*)
Elodea occidentalis (*Anacharis occidentalis*) (Western waterweed)						
2,4-D		5 lb		Complete kill	30-minute contact	(*180*)
2,4-D, IPE		13.4 lb		100 percent	Greenhouse tests, 6 weeks	(*181*)
		11.3 lb		do	do	(*181*)
		8.4 lb		do	do	(*181*)
		5.9 lb		do	do	(*181*)
		5.1 lb		do	do	(*181*)
Aromatics	300			Satisfactory	Irrigation channels, 30-minute contact.	(*239*)
Benoclor 3C	300			Killed	Irrigation channel, 1-hour exposure.	(*125*)
Coal tar naphtha solvent		493.2 gal		100 percent	Greenhouse tests, 6 weeks	(*181*)
Heteranthera dubia (Water stargrass)						
2,4-D, acid	5		Acetone or ethanol	100 percent	Plastic-pool tests, Auburn, Ala., 6 months.	(2)
2,4-D		7 lb. or less		Complete kill	30-minute contact	(*180*)

2,4-D, acetamide	----------	10 lb	Granules	40 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(248)
	----------	20 lb	do	70 percent	do	(248)
	----------	40 lb	do	80 percent	do	(248)
2,4-D, BEE	----------	10 lb	Granules	100 percent	Drainage ditch, Ark., slow-moving water.	(211)
	----------	10 lb	do	do	Treated May 26, checked Sept. 18, drainage ditch, Ark.	(248)
	----------	20 lb	do	do	do	(248)
	----------	40 lb	do	do	do	(248)
2,4-D, IPE	----------	27.5 lb	----------	100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(181)
	----------	19.1 lb	----------	do	do	(181)
	----------	8.6 lb	----------	do	do	(181)
	----------	4.6 lb	----------	do	do	(181)
2,4,5-T, DMS	----------	10 lb	Granules	30 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(248)
	----------	20 lb	do	70 percent	do	(248)
	----------	40 lb	do	90 percent	do	(248)
Silvex	1	----------	----------	Satisfactory	Research trials, spray, N.J	(97)
	----------	10 lb	Granules	50 percent	Treated June 5, checked Sept. 18, drainage ditch, Ark.	(248)
	----------	20 lb	do	60 percent	do	(248)
	----------	40 lb	do	80 percent	do	(248)
	1	----------	----------	100 percent	Pond tests, N.J., 3–4 weeks	(252)
Silvex, acid	5	----------	Acetone or ethanol	100 percent	Plastic-pool tests, Auburn, Ala., 6 months.	(2)
Monuron	----------	10 lb	Granules	30 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(248)
	----------	20 lb	do	50 percent	do	(248)
	----------	40 lb	do	60 percent	do	(248)
Diuron	----------	10 lb	Granules	None	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(248)
	----------	20 lb	do	do	do	(248)
	----------	40 lb	do	do	do	(248)
Amitrole	----------	10 lb	Granules	20 percent	Treated June 20, checked Sept. 18, drainage ditch Ark.	(248)
	----------	20 lb	do	40 percent	do	(248)
	----------	40 lb	do	70 percent	do	(248)
Simazine	----------	10 lb	Granules	10 percent	Treated July 18, checked Sept. 18, drainage ditch, Ark.	(248)
	----------	20 lb	do	30 percent	do	(248)
	----------	40 lb	do	50 percent	do	(248)
Aromatic solvent	More than 740.	10 gal./c.f.s	----------	Control to 5 miles below.	Irrigation channels, 30-minute contact needed; recommended rate.	(117)
	300	----------	----------	Satisfactory	Irrigation canals, West, 30-minute contact.	(239)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
		Heteranthera dubia (Water stargrass)—Continued				
	P.p.m.[1]					
Coal tar naphtha solvent		441 gal		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
Sodium arsenite	1. 7–2			Killed	Pond tests	(*229*)
	2. 5–4				Recommended rate	(*188*)
	2. 5				Ponds; recommended rate	(*232*)
	1–1. 7			Successful	Pond tests, Ohio	(*227*)
Sodium chlorate		1,175.5 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
CIPC		10 lb	Granules	20 percent	Treated July 18, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	40 percent	do	(*248*)
		40 lb	do	60 percent	do	(*248*)
PBA, dimethylamine		10 lb	Granules	70 percent	Treated June 5, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	100 percent	do	(*248*)
		40 lb	do	do	do	(*248*)
2,3,6 TBA, sodium salt		10 lb	Granules	60 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	70 percent	do	(*248*)
		40 lb	do	90 percent	do	(*248*)
		Hydrochloa caroliniensis (Southern watergrass)				
2,4-D (Weedone)		8 lb	Water	98 percent	Dewatered pond area	(2)
		16 lb	do	100 percent	do	(2)
2,4-D, BE		3 lb	Water	95 percent	Dewatered pond area	(2)
		3 lb	Diesel fuel	100 percent	do	(2)
		8 lb	do	do	do	(2)
		16 lb	do	do	do	(2)
2,4-D, IOE		86 lb	Granules	None	Pond treatment, Ga., 1959	(*211*)
2,4-D, NH_4 salt		20 to 40 lb	Water	Poor kill	Dewatered pond area	(2)
2,4-D, Na salt		8 lb	Water	80 and 50 percent	Dry bank and damp bottom	(2)
		16 lb	do	95 and 70 percent	do	(2)
		32 lb	do	100 and 85 percent	do	(2)
		3 to 16 lb	do	Poor kill	Dewatered pond area	(2)
Silvex, PGBEE		3 lb	Water (1:5)	None	Pond tests, Ga., 1959	(*211*)
		34 lb	Water (1:17)	do	do	(*211*)
Dalapon		20 lb	Water, 80 gal	None	Spray application, pond tests, Ga.	(*236*)
		2,000 lb	Granules	None; 100-percent regrowth within 1 year.	Pond tests, Ga	(*235*)
Erbon		32 lb	Water, 80 gal	Burned, no kill	Spray application, pond tests, Ga.	(*236*)

AMS	----------	400 lb	Water	Fair kill	Pond tests	(2)
	----------	400 lb	do	Partial	Dewatered pond area	(2)
	----------	400 lb	do	Complete	do	(2)
Simazine	----------	7.2 lb	Granules	None	Pond tests, Ga	(235)
Sodium arsenite	4–8	----------	----------	No effect	Pond tests	(2)
Chlorea	----------	860 lb	Granules	None	Treated in 1958, checked in 1959, pond tests, Ga.	(235)
Diesel fuel	----------	10 gal	----------	25 percent; no regrowth same year.	Treated Aug. 13, 1959, pond tests, Ga.	(235)
Hypericum spp. (St.-Johns-worts)						
2,4-D, amine+ester	----------	3 lb.+6 lb	Water	65 percent	Treated June 1 and July 31, sprayed, Mont. Multifilm X.	(226)
2,4-D, amine	----------	3 lb	Diesel oil, 50 gal	95 percent	Treated June 25, sprayed, Wash.	(226)
	----------	2 lb	Water (1:133)	94 percent	Treated June 21, Wash	(224)
	----------	3 lb	do	92 percent	Treated June 6, Wash	(224)
	----------	4 lb	do	85 percent	Treated July 2, Wash	(224)
	----------	2 lb	Water	92 percent	Treated July 18, spray	(241)
	----------	3 lb	do	90 percent	Treated July 27, spray	(241)
	----------	3 lb	do	85 percent	Treated Aug. 1, spray	(241)
2,4-D, IPE	----------	2.5 lb	Water	95 percent	Treated June 23, spray	(241)
	----------	2 lb	do	98 percent	Treated Aug. 1, spray	(241)
Juncus spp. (Rushes)						
Copper sulfate	3	----------	----------	No effect	Pond tests	(206)
Juncus roemerianus (Needlerush)						
2,4-D, amine	----------	20 lb	Water	75–99 percent	Treated Jan. 26 and Mar. 11	(224)
2,4-D, ester	----------	16.7 lb	----------	99–100 percent	Treated Apr. 4, airplane	(224)
	----------	16.7 lb	Undiluted	99 percent	Treated Apr. 1 to 7, airplane, Fla.	(226)
	----------	16.7 lb	do	98 percent	Treated Apr. 8, airplane, Fla.	(226)
2,4-D	----------	16.7 lb	----------	65 percent	Treated in Apr., airplane, Fla	(226)
	----------	27 lb	----------	Eradicated	----------	(174)
	----------	7 lb	----------	75–90 percent	----------	(174)
	----------	6 to 17 lb	----------	100 percent; seasonal kill.	Research trials	(97)
	----------	16.7 lb	----------	99 percent	Air treatment in Apr., 21 acres, refuge.	(98)
2,4-D, IPE	----------	6 lb	Diesel oil, 17 lbs	85–100 percent	Treated Apr. 15, airplane, Fla.	(224)
	----------	16 lb	----------	90–95 percent	Aerial application	(178)
	----------	20 lb	Water	Effective	Ground application	(178)
Herbicidal oil+2,4,5-T	----------	34 gal.+3 lb	----------	Good	Oil spray followed 2 days later by 2,4,5-T.	(174)
Silvex, PGBEE	----------	2 lb	Diesel oil, 5 gal	23 percent	Air treatment in May	(211)
	----------	3 lb	do	44 percent	do	(211)
	----------	6 lb	do	58 percent	do	(211)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Juncus roemerianus (Needlerush)—Continued						
	P.p.m.[1]					
Dalapon		30 lb	Water	Good	Treated July 18, spray	(*224*)
		60 lb	do	do	do	(*224*)
		10 lb	do	None	do	(*224*)
		20 to 30 lb	do	Slight	do	(*224*)
		60 lb	do	90 percent	do	(*224*)
		10 lb	do	83 percent	Treated in Apr., spray	(*101*)
		20 lb	do	99 percent	do	(*101*)
		30 lb	do	40 percent	do	(*101*)
		60 lb	do	99 percent	do	(*101*)
		20 lb	do	Good	Treated July 18, spray	(*224*)
Dalapon + wetting agent		20 lb	¼ % Tergitol #4	70 percent	Moist land area, SE	(*224*)
		40 lb	do	do	do	(*224*)
		60 lb	do	do	do	(*224*)
		80 lb	do	75 percent	do	(*224*)
Erbon	2			Unsatisfactory	Research trials, N.J	(*97*)
Jussiaea diffusa (Waterprimrose)						
2,4-D, BE		2.4 lbs	Kerosene	Good	Lake tests, TVA	(*147*)
Jussiaea peruviana (Waterprimrose)						
2,4-D, amine		4 lb	Water	80–90 percent		(*211*)
2,4,5-T, amine		4 lb	do	90–100 percent		(*211*)
Silvex, PGBEE		4 lb	do	do		(*211*)
Fenuron		20 lb	Granules	80–100 percent		(*211*)
Monuron (WP)		20 lb	Water	95 percent		(*211*)
Monuron + TCA		22 lb	Granules	70–90 percent		(*211*)
Diuron		20 lb	do	98 percent		(*211*)
Jussiaea repens (Waterprimrose)						
2,4-D, alkanolamine		3 lb	Oil, 2 gal	100 percent	10 acres, air treatment, shallow water.	(*211*)
2,4-D, BEE		10 to 20 lb	Granules	80–90 percent	Plants in 6–30 inches water	(*211*)
Jussiaea uruguayensis (*J. grandiflora*) (Waterprimrose)						
2,4-D		80 to 100 lb	Granules	Complete	Treated May 27, checked June 24, pond tests, Ark.	([3])
		1.5 lb	Water	Killed	Ricefield	(*200*)

2,4-D, DMS		2 lb	Water+.02% Lux	100 percent	Plots in La. bayou, checked in 30 days.	(151)
		4 lb	do	do	do	(151)
		6 lb	do	do	do	(151)
2,4-D, BE		3 lb	Diesel fuel	Excellent	Pond tests	(2)
		2 lb	Water	Good	do	(104)
		4 lb	do	do	do	(2)
		2 lb	Water+2% Tide	Excellent	do	(175)
2,4-D, IOE		2 lb	Water+.02% Lux	100 percent	Plots in La. bayou, checked in 30 days.	(151)
		4 lb	do	do	do	(151)
		6 lb	do	do	do	(151)
2,4-D, IPE		3.34 lb	Water	90 percent	Treated May 27, plants in water, Ga.	(101)
		2 to 3.34 lb	Oil or water	75 percent; 25-percent regrowth in 2 seasons.		(211)
		2 to 4 lb	Diesel fuel	Fair to good	Pond tests	(2)
		4 to 6 lb	Water	do	do	(2)
		6 to 8 lb	Diesel fuel	Good	do	(2)
2,4-D, Na salt		4 to 6 lb	Water	Good	Pond tests	(2)
MCPA, alkanolamine		2 lb	Water+.02% Lux	100 percent	Plots in La. bayou, checked in 30 days.	(151)
		4 lb	do	do	do	(151)
		6 lb	do	do	do	(151)
2,4,5-T		4 lb	Water+2% Tide	Good	Pond tests	(175)
2-(2,4,5-T), butyl ester		2 lb	Water+.02% Lux	100 percent	Plots in La. bayou, checked in 30 days.	(151)
		4 lb	do	do	do	(151)
		6 lb	do	do	do	(151)
AMS		150 to 300 lb	Detergent	Killed tops; regrowth from roots.	Pond tests	(103)
		150 lb	Water+Vatsol OS.	Partial kill	do	(103)
2,3,6 TBA		1.5 to 12 lb	Water	Ineffective	Treated May 20, plants in water, Ga.	(241)
Myriophyllum spp. (Milfoils)						
Silver	0.5			100 percent	3 pond tests, NE	(123)
	.3			do	Pond test, NE	(123)
Silvex, PGBEE	2			Controlled	5 pond tests	(148)
Simazine		10 to 26 lb		Controlled; regrowth in 2 months.	Drained irrigation ditch	(135)
Myriophyllum brasiliense (Parrotsfeather)						
2,4-D		400 lb	Granules	100 percent for 1 year	10-percent granular form	(119)
2,4-D, amine		3 lb	Water (1:80)	100 percent; no regrowth within year.	Pond tests, Ga	(235)
		5 lb	Water (1:40)	100 percent in 1958; 100 percent regrowth in 1959.		(235)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Myriophyllum brasiliense (Parrotsfeather)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.[1]					
2,4-D, IOE		30 lb	Granules	100 percent	Broadcast application, pond tests, Ga.	(*236*)
		30 lb	do	do	do	(*236*)
		20 lb	do	100 percent; treated in 1958, no regrowth 2d year.	Pond tests, Ga	(*211*)
		120 lb	do	do	do	(*211*)
2,4-D, IPE		3 lb	Water	100 percent	Irrigation channels	(*180*)
		3 lb		do	⅔ in 1st application, ⅓ in second. Greenhouse tests, checked 6 weeks after application.	(*181*)
2,4-D, NH_4 salt		2 lb	Water	Killed exposed leaves	Pond tests	(2)
2,4-D+2,4,5-T, IOE		20 lb	Granules	90 percent	Pond tests, Ga., 1959	(*235*)
2,4,5-T, inverton		.75+.3 lb	Water (1:50)	50–100 percent	Repeated treatments, pond, Ga., 1959.	(*235*)
Silvex	1			100 percent	Spray application, pond tests, Ga.	(*236*)
		8 lb		do	do	(*236*)
		4 lb		do	do	(*236*)
	2			do	Pond tests, 6 weeks	(2)
	5			100 percent; a very limited regrowth within 6 months.	Pond tests	(2)
Silver, PGBEE		1.5 lb	Water	100 percent		(*211*)
		3 lb	do	100 percent; no regrowth following year.	Pond tests, Ga., 1958	(*211*)
	.25			do	do	(*211*)
	1			do	do	(*211*)
Dalapon		15 lb	Water (1:20)	20 percent; 50-percent regrowth same year.	Pond tests, Ga., 1959	(*235*)
Monuron	17		Granules	100 percent	Greenhouse tests, 10 months	(*181*)
	10–19			Killed	Dewatered ditch area	(*180*)
Erbon		16 lb		100 percent	Spray application, pond tests, Ga.	(*236*)
		16 lb		50 percent	do	(*236*)
Benoclor		1 gal./sq. ft		Eliminated	Sprayed onto plants	(*239*)
	300			Fairly resistant	Irrigation channels, 1-hour exposure.	(*125*)
Sodium arsenite	3–4				Ponds; recommended rate	(*232*)

Myriophyllum exalbescens (Water-milfoil)

Silvex	2–2.5			Satisfactory	Research trials, N.J	(*97*)
	0.5–2.5			Promising	do	(*97*)
	.5			Unsatisfactory	do	(*97*)

Amitrole	20			No kill	4-week tests, Mich	(144)
	40			do	do	(144)
	100			do	do	(144)
	10			do	Aquaria tests	(144)
	20			do	do	(144)
	40			do	do	(144)
Erbon	2			Unsatisfactory	Research trials, N.J	(97)
Dichlone	0.75–1				Trial use suggested	(169)
Benoclor 3C	300			Partial kill	Irrigation channel, 1-hour exposure.	(125)
Sodium arsenite	5			Browned but regrowth	4-week tests, Mich	(144)
	10			do	do	(144)
	20			do	do	(144)
Esso WS–1492	3			Satisfactory	Research trials, Del	(97)
		20 gal		100 percent; some regrowth in 3.5 months.		(224)
2, 4-D	10			Leaves green, no growth.	Aquaria tests, 4 weeks	(144)
	10			15 percent kill	Pond tests, applied on ice	(144)
	20			Leaves green, no growth.	Aquaria tests, 4 weeks	(144)
	40			do	do	(144)
	20		Granules		20-percent granular form; recommended rate.	(144)
		400 lb	do	100 percent	10-percent granular form	(119)
2,4-D, amine	10			Stems pink and weak	4-week tests, Mich	(144)
	20			do	do	(144)
	40			do	do	(144)
2,4,5-T	10			Stems pink and weak	4-week tests, Mich	(144)
	20			do	do	(144)
	40			do	do	(144)
	5			Stems white, leaves green.	Aquaria test, 4 weeks	(144)
	10			do	do	(144)
	20			do	do	(144)
Silvex	1–2				Trial use suggested	(169)

Myriophyllum heterophyllum (Milfoil)

2,4-D	20			Complete	Pond tests, applied on ice	(144)
		100 lb	Granules		20-percent granular form; recommended rate.	(197)
2,4-D, amine	2		Water (1:12)	100 percent	Pond test, Ga., 1959	(235)
2,4-D+2,4,5-T		4 lb	Water, 80 gal	do	Spray application, pond tests, Ga.	(236)
2,4-D, IOE		86 lb	Granules	100 percent; 100-percent regrowth within year.	Broadcast application, pond tests, Ga.	(235, 236)
		43 lb	do	None	do	(236)
		20 lb	do	100 percent	do	(236)
2,4,5-T, ester		4 lb	Water, 80 gal	100 percent	Spray application, pond tests, Ga.	(236)
2,4,5-T, IPE	.5		Water (1:20)	do	Pond tests, Ga., 1959	(235)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Myriophyllum heterophyllum (Milfoil)—Continued						
	P.p.m.[1]					
Silvex	1.2			100 percent; no regrowth within year.	Gravity-flow application, pond tests, Ga.	(*235*, *236*)
	.5			do	Spray application, pond tests, Ga.	(*235*, *236*)
		8 lb	Water, 80 gal	100 percent	do	(*236*)
	.5			None; plots reinfested.	Pond tests, N.J	(*252*)
	2			95–100 percent; plots reinfested.	do	(*252*)
	2.5			do	do	(*252*)
Silvex, PGBEE	.2		Water (1:16)	99 percent	Pond tests, Ga., 1959	(*235*)
Dalapon+silvex		3 lb.+.4 lb	Water (1:80)	10 percent	do	(*235*)
DCB		20 gal		Killed; death 1 to 4 weeks, effective 2+ years.		(*131*)
Erbon		8 lb	Water, 80 gal	100 percent	Spray application, pond tests, Ga.	(*236*)
		16 lb	do	25 percent	do	(*236*)
Dichlone	2–2.5			Killed	Pond tests, 21 days	(*251*)
TCE	0.5–0.75			Effective		(*182*)
Benoclor 3C		20 gal		50 percent		(*131*)
Carbon bisulfide	300			Partial kill	Irrigation channel, 1-hour exposure.	(*125*)
Carbon tetrachloride		20 gal		75 percent		(*131*)
		20 gal		50 percent		(*131*)
Sodium arsenite	5			Killed tops, root regrowth.	Aquaria tests, 4 weeks	(*144*)
	10			do	do	(*144*)
	20			do	do	(*144*)
	7			Effective	Treatment of entire pond	(4)
	2.7–4				Recommended rate	(*188*)
	3–4				Ponds, recommended rate	(*232*)
Myriophyllum verticillatum (Milfoil)						
2,4-D	5			100 percent	Greenhouse tests, 42 days	(*198*)
	10			do	Greenhouse tests, 10 days	(*198*)
Sodium arsenite	10			100 percent	Greenhouse tests, 10 days	(*198*)
Ammonium thiocyanate	100			do	Greenhouse tests, 28 days	(*198*)

Najas spp. (in most cases *N. quadalupensis*) (Naiads)

2,4-D		80 lb	Granules	2 percent	Treated Feb. 12, 1958, Fla	(*121*)
		80 lb	do	do	Treated Mar. 7, 1958, Fla	(*121*)
		24 lb	do	None	Treated Apr. 23, 1958, Fla	(*121*)
		80 lb	do	Effective	Pond tests	(2)
		40 lb	do	Some kill	do	(2)
		10 lb	do	Practically no effect	do	(2)
		100 lb	do		20-percent granular form; recommended rate.	(*197*)
2,4-D, ester	15			None	Pond test, N.J. (*N. flexilis*)	(*159*)
2,4,D, TEA	10			Killed	Aquaria tests	(*231*)
2,4-D, IOE		20 lb	Granules	None to partial	Treated in May, checked in 6 weeks, pond test, Ark.	(3)
		20, 40 lb	do	None	Drainage ditch, Ark., treated after draining.	(*211*)
		20 lb	do	20 percent	Hatchery ponds, Ala., drained in 6 weeks (*N. flexilis*).	(*211*)
		20 lb	do	100 percent	Killed some fish, pond test, Tex. (*N. guadalupensis*).	(*211*)
		30 lb	do	do	Lake tests, Tex. (*N. guadalupensis*).	(*211*)
2,4-D, NH_4 salt	12			100 percent	Pond tests	(2)
2,4,5-T, amine		4 lb	Water, 80 gal	None	Spray application, pond tests, Ga.	(*236*)
2,4,5-T		24 lb	Granules	do	Treated Apr. 23, 1958, Fla	(*121*)
Silvex, PGBEE	2			80 percent	Pond tests, 6 weeks	(2)
	5			100 percent; limited regrowth within 6 months.	Pond tests	(2)
	2		Granules	100 percent	Pond tests, Ga., 1959	(*235*)
		20 lb	Water	None	Treated Apr. 23, 1958, Fla	(*121*)
	2			90 percent; control after 4 weeks.	Fla. (*N. guadalupensis*)	(*211*)
	2			100 percent for 1 year	In tank, Fla. (*N. guadalupensis*).	(*211*)
TCA		130 lb		75-percent kill	Into pond water, 7 weeks	(2)
Dalapon+silvex, PGBEE		5 lb.+12 lb	Water	100 percent	Pond tests, Ga., 1959	(*235*)
Monuron+TCA		44 lb.+88 lb	Granules	None	Drainage ditch, Fla., treated after draining.	(*211*)
Monuron		50 to 100 gm./10 sq. meter.	Water		Ponds in Israel (*N. minor*); recommended rate.	(*201*)
	4.6	25 lb		90 percent	Pond tests, N.J. (*N. flexilis*)	(*159*)
	9.2	50 lb		95 percent	do	(*159*)
	15.4	100 lb		100 percent	do	(*159*)
Diuron	1.2			Good	Dewatered pond bottom	(*107*)
	1.2			Eliminated	Pond tests	(2)
Aromatics	300			Satisfactory	Irrigation channels, 30-minute contact.	(*239*)
Benoclor 3C		750 gal./35 acres+700 gal./25 acres.		do	*N. flexilis*	(*246*)
Copper sulfate		500 lb		90 percent	Pond tests, N.J.; 8 percent maximum area treated one time.	(*159*)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Najas spp. (in most cases *N. quadalupensis*) (Naiads)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.[1]					
Sodium arsenite	8			Killed	Pond tests, Ala.	(*209*)
	2.5–4				Recommended rate	(*188*)
	1–4			Complete kill	2 applications, pond tests	(*149*)
	2.5				Ponds; recommended rate	(*232*)
	2			No kill	2 applications, concrete pools	(2)
	4			do	do	(2)
	8			do	do	(2)
	4			100 percent	Gravity-flow application, pond tests, Ga.	(*236*)
		20, 40, 80 lb	Granules	None	Farm ditch, Fla. No-flow water.	(*211*)
	9			100 percent	do	(*211*)
Sodium arsenite (Atlas "A")	50.3			None	Treated Nov. 20, 1957, Fla.	(*121*)
	10.6		Water	do	do	(*121*)
	17.6		do	do	do	(*121*)
	11.6		do	do	do	(*121*)
Sodium thiocyanate	1			Stimulated growth	Concrete pools	(2)
	2			do	do	(2)
	4			do	do	(2)
Acrolein	87			100 percent	Applied at pump into dug ditch, Fla., 68-minute contact.	(*211*)
	6			90 percent	Applied at points in ditch, Fla.	(*211*)
Granular chlorea		393 lb		None	Treated Apr. 23, 1958, Fla.	(*121*)
Aromatic Esso WS–1492	250–300			95 percent; 3- to 4-month control.	99.5-percent aromatic, Fla., 48+ hours contact.	(*204*)
Aromatic Esso WS–1494	250–300			Unsatisfactory	77-percent aromatic, 48+ hours contact.	(*204*)
Aromatic Esso WS–1495	250–300			Unsatisfactory; 23-week control.	35-percent aromatic, 48+ hours contact.	(*204*)
Emul WS–1492, 77%+PCB 22%.	200		Monsanto L emul. 5%.	80 percent	72 percent in ditch plots, 48-hour drawdown, Fla.	(*220*)
HT solvent 78%+PCB 18%	200		Triton X 155 emul. 5%.	54 percent	do	(*220*)
Emul WS–1492	200			66 percent	78 percent in ditch plots, 48-hour drawdown, Fla.	(*220*)
HT solvent 41%+ drip oil 41%+PCB 13%.	200		Triton X 155 emul. 5%.	74 percent	84 percent in ditch plots, 48-hour drawdown, Fla.	(*220*)
Emul trichlorobenzene	200			do	88 percent in ditch plots, 48-hour drawdown, Fla.	(*220*)
Amsco HT solvent 95%	200		Triton X 155 emul. 5%.	50 percent	66 percent in ditch plots, 48-hour drawdown, Fla.	(*220*)
Tar oil 78%+PCB 17%	200		Monsanto L emul. 5%.	66 percent	do	(*220*)
Tar oil 95%	200		do	do	46 percent in ditch plots, 48-hour drawdown, Fla.	(*220*)
Drip oil 95%	200		Triton X 155 emul. 5%.	do	42 percent in ditch plots, 48-hour drawdown, Fla.	(*220*)

Drip oil 74%+PCB 21%	200		do	80 percent	90 percent in ditch plots, 48-hour drawdown, Fla.	(220)
Light oil 95%	200		Monsanto L emul. 5%.	66 percent	38 percent in ditch plots, 48-hour drawdown, Fla.	(220)
Light oil 78%+Monsanto PCB 17%.	200		do	74 percent	66 percent in ditch plots, 48-hour drawdown, Fla.	(220)
Phillips A.S.-D 67%+PCB 28%.	200		do	94 percent	do	(220)
Phillips A.S.-D 95%	200		Triton X 155 emul. 5%.	66 percent	52 percent in ditch plots, 48-hour drawdown, Fla.	(220)
	400		Monsanto L emul. 5%.	100 percent	70 percent in ditch plots, 48-hour drawdown, Fla.	(220)
	800		do	do	do	(220)
Leaded gasoline + trichlorobenzene, sp. gr. 1.	400			Satisfactory; 5- to 6-month control.	Organic soils, Fla	(220)
Leaded gasoline + trichlorobenzene, sp. gr. .95.	125			do	do	(220)
HT solvent + PCB, sp. gr. 1.15.	100			Good; 5- to 6-month control.	do	(220)
Potamogeton spp. (Pondweeds)						
2,4-D		40 lb	Granules	Some kill	Pond tests	(2)
2,4-D, Dowanol		20 lb	do	None	Lake, pH 9.1-9.3	(211)
		20 lb	do	100 percent	Lake, pH 5.5	(211)
2,4-D, BE		2 lb	Water	No control	Pond tests	(104)
2,4-D, IOE		20 lb	Granules	100 percent	Treated May 7, checked June 24, pond tests, Ark.	(3)
		20 lb	do	None	Lake tests, N.J	(160)
		40 to 60 lb	do	Killed	do	(160)
2,4-D, Na salt	10-15			90-95 percent	Pond tests	(2)
Silvex	.5			None	Pond tests, N.J., 3-4 weeks	(252)
	2			do	do	(252)
	2.5			95-100 percent	do	(252)
	3			do	do	(252)
	2			95-100 percent; plants killed.	Pond tests, 28 days	(2)
	5			100 percent; no regrowth in 6 months.	Pond tests.	(2)
	0.5-2.5			Unsatisfactory	Research trials, N.J	(97)
	0.2-0.5			0-50 percent	Pond tests	(123)
Silvex, PGBEE	2			100 percent	Pond tests, Ga., 1959	(235)
Silvex, acid, Na salt, PGBEE		20 lb		do	Lake, pH 5.5	(211)
		20 lb		None	Lake, pH 9.1-9.3	(211)
TCA		130 lb		75-percent kill	Pond tests, 7 weeks	(2)
Fenuron		10, 20, 40 lb	Granules	100 percent	Mixture of pondweeds	(211)
Monuron	Less than 10			Complete kill	Pond tests	(180)
		5 lb		Initial kill; regrowth 2d year.	Irrigation ditches	(158)
		10 lb		do	do	(158)
		20 lb		do	do	(158)
		40 lb		do	do	(158)
		80 lb		do	do	(158)
		15 lb		Unsatisfactory	Research trials, N.J	(97)
Diuron	2.5			Killed	Pond tests, Oreg	(109)
		10, 20, 40 lb	Granules	100 percent	Mixture of pondweeds	(211)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Potamogeton spp. (Pondweeds)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.[1]					
DCB		40 gal		Killed; death in 1–4 weeks, effective 2 or more years.		(*131*)
Erbon	2–3. 9			Killed	Pond tests, 21 days	(*251*)
				Promising	Pond tests, sprayed, N.J	(*97*)
	2. 5			Unaffected	Pond tests, 21 days	(*251*)
Simazine	5		Granules	Killed	5 applications in enclosed pond area, Mo.	(*135*)
	1. 25–6			Partial; from poor to good control for 1 month.	Pond test	(*135*)
TCE		40 gal		50 percent		(*131*)
Chloroben (Benoclor 3C)		750 gal./35 acres + 700 gal./25 acres.		Satisfactory	Pond tests, N.Y. (partial treatments) (*P. gramineus*).	(*246*)
Carbon bisulfide		40 gal		75 percent		(*131*)
Carbon tetrachloride		40 gal		50 percent		(*131*)
Naphtha solvents	600–1, 400			Effective	1-hour contact	(*125*)
Borascu	350–650			Eliminated		(*180*)
		960 lb		Initial kill; regrowth 2d year.	Irrigation ditches	(*158*)
		1,920 lb		do	do	(*158*)
Copper sulfate	3			None	Lake tests	(*206*)
	0. 3–0. 8			Killed	Pond test	(*146*)
	200			85-percent killed	Retreated 3–4 weeks; concentration maintained for 1 hour.	(*239*)
	100			50–60 percent	Retreatment necessary, concentration maintained for 1 hour.	(*239*)
$KMnO_4$	15–20			Good kill	On wet bottom of ditch	(2)
Sodium arsenite	1		Water	No kill	Sprayed on surface leaves	(2)
	7				General recommendation	(*169*)
	4			100 percent	Gravity-flow application, pond tests, Ga.	(*236*)
	3. 8			Satisfactory	Pond tests, N.J	(*97*)
	2–5			do	Pond tests, N.H	(*97*)
	4–5				Ponds in Israel; recommended rate.	(*201*)
	8			Killed	Pond tests, Ala	(*209*)
	1–1. 7			Successful	Pond tests, Ohio (*P. interior*)	(*227*)
Sodium chlorate		160 lbs		Initial kill; regrowth in 2d year.	Irrigation ditches	(*158*)
		320 lbs		do	do	(*158*)
		640 lbs		do	do	(*158*)

Delrad	0.5–1			95–100 percent	Pond tests, N.J	(97)
Borascu	10			None	Pond tests	(2)
CIPC		10, 20, 40 lb	Granules	100 percent	Mixture of pondweeds	(211)
Hexachlorocyclopentadiene		10, 20, 40 lb	do	do	do	(211)
Potamogeton amplifolius (Pondweed)						
2,4-D	1.5	10 lb	Granules	Partial; regrowth in 1 month.	Pond tests, N.Y	(192)
Silvex, PGBEE	1.2			None	do	(191)
Potamogeton compressus (Pondweed)						
Sodium arsenite	1.7–2			Killed	Pond tests	(230)
Potamogeton crispus (Crinkled-leaf pondweed)						
2,4-D	1.5	10 lb	Granules	Partial; regrowth in 1 month.	Pond tests, N.Y	(192)
MCPA	10			Killed	Aquaria tests	(234)
2,4,5-T, TBP	10			do	do	(234)
Silvex	1			95–100 percent	Pond test, N.J., 3–4 weeks	(252)
Silvex, PGBEE	1.2			None	Pond tests, N.Y	(191)
IPC	10			Arrested growth, no kill.	Aquaria tests	(234)
Monuron	4.6	25 lb		90 percent	Pond tests, N.J	(159)
	9.2	50 lb		95 percent	do	(159)
	15.4	100 lb		100 percent	do	(159)
AMS	10			No effect	Aquaria tests	(234)
2,4-D, TBP	10			Killed	do	(234)
2,4-D, TEA	10			do	do	(231)
Copper sulfate		500 lb	Granules	98 percent; regrowth within year.	Lake tests, N.J	(160)
		400 lb		90 percent	Pond tests, N.J	(159)
		500 lb		do	do	(159)
Sodium arsenite	2.5			Good kill	Pond tests	(230)
	2.5–4				Ponds; recommended rate	(188)
	2.5				do	(232)
Potamogeton diversifolius (Pondweed)						
2,4-D acid	5		Acetone or ethanol.	100 percent	Plastic-pool tests, Auburn, Ala, 3 months.	(2)
Silvex acid	5		do	do	do	(2)
AMS		1 lb./gal./100 sq. ft.	Water+Vatsol OS	Killed leaves	Pond tests	(103)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Potamogeton epihydrus or *P. foliosus* (Leafy pondweed)						
	P.p.m.[1]					
2,4-D		5 lb		95-percent kill	30-minute contact	(*180*)
2,4-D, Na salt	89			100 percent	10 months, 100-percent Spirogyra.	(*181*)
Monuron	7.3			do	10 months	(*181*)
Endothal	24			95-percent kill	Cuttings, 30-minute contact	(*102*)
	60			99-percent kill	do	(*102*)
	120			100-percent kill	do	(*102*)
	48			98-percent kill	Rooted plants, 30-minute contact.	(*102*)
	25			100-percent kill	Rooted plants, 4-day contact	(*102*)
Aromatic solvent	540	5.5 to 5.9 gal./c.f.s		Needed for control	Irrigation channel, ¾ to 1½ miles for 5 to 6 weeks.	(*117*)
	600	8 gal./c.f.s		do	Irrigation channels, up to 3 miles for 8 weeks.	(*117*)
	740	10 gal./c.f.s		do	Irrigation channels, up to 5 miles for 8 weeks.	(*117*)
Sodium arsenite	2.5–4				Ponds; recommended rate	(*188*)
	2.5–4				do	(*188*)
	2				do	(*232*)
Delrad	100			100-percent top kill; 100-percent regrowth.	10 months	(*181*)
Sodium borate	342			75 percent	10 months, 75-percent cover horned pondweed.	(*181*)
Potamogeton filiformis (*P. interior*) (Fine-leaf pondweed)						
2,4-D, TEA	10			Killed	Aquaria tests	(*234*)
Sodium arsenite	1.7–2			do	Pond tests	(*230*)
	2				Ponds; recommended rate	(*232*)
Hyman P–162	4.5			Good	Pond tests, Oreg	(*109*)
Potamogeton foliosus (Leafy pondweed)						
2,4-D, acetamide		10 lb	Granules	40 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	70 percent	do	(*248*)
		40 lb	do	80 percent	do	(*248*)
2,4-D, BEE		10 lb	Granules	70 percent	Checked 6–10 weeks after treated, Ark.	(*247*)
		10 lb	do	100 percent	Treated May 26, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	do	do	(*248*)
		40 lb	do	do	do	(*248*)

2,4-D, IPE		8.2 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(181)
		6.9 lb		do	do	(181)
		5.6 lb		95 percent	do	(181)
		4.9 lb		100 percent	do	(181)
		3.5 lb		15 percent	do	(181)
2,4-D, TEA	10			Killed	Aquaria tests	(234)
2,4,5-T, DMS		10 lb	Granules	30 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(248)
		20 lb	do	70 percent	do	(248)
		40 lb	do	90 percent	do	(248)
Silvex		10 lb	Granules	50 percent	Treated June 5, checked Sept. 18, drainage ditch, Ark.	(248)
		20 lb	do	60 percent	do	(248)
		40 lb	do	80 percent	do	(248)
Monuron		10 lb	Granules	30 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(248)
		20 lb	do	50 percent	do	(248)
		40 lb	do	60 percent	do	(248)
		36.1 lb		None	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(181)
Diuron		10 lb	Granules	None	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(248)
		20 lb	do	do	do	(248)
		40 lb	do	do	do	(248)
Endothal	24			95 percent	Excised, 5 weeks	(181)
	60			99 percent	do	(181)
	120			100 percent	do	(181)
	48			98 percent	Rooted plants, 5 weeks	(181)
	240			100 percent	do	(181)
	25			do	do	(181)
MH		248.1 lb		None	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(181)
Amitrole		10 lb	Granules	20 percent	Treated June 20, checked Sept. 18, drainage ditch, Ark.	(248)
		20 lb	do	40 percent	do	(248)
		40 lb	do	70 percent	do	(248)
Simazine		10 lb	Granules	10 percent	Treated July 18, checked Sept. 18, drainage ditch, Ark.	(248)
		20 lb		30 percent	do	(248)
		40 lb		50 percent	do	(248)
Coal tar naphtha solvent		159.4 gal		None	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(181)
Copper sulfate	.5		Water	Good	Beaker tests, 30-minute contact, 6 weeks.	(181)
	5		do	do	do	(181)
	10		do	Very poor	do	(181)
	20		do	do	do	(181)
	40		do	do	do	(181)
	80		do	do	do	(181)
		195 lb		None	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(181)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Potamogeton foliosus (Leafy pondweed)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.[1]					
Sodium arsenite	.5		Water	Complete	Beaker tests, 30-minute contact, 6 weeks.	(*181*)
	5		do	Good	do	(*181*)
	10		do	Partial	do	(*181*)
	20		do	do	do	(*181*)
	40		do	do	do	(*181*)
	80		do	Poor	do	(*181*)
	1.7–2		do	Killed	Pond tests	(*230*)
	2.5			Good kill	do	(*230*)
	1–1.7			Successful	Pond tests, Ohio	(*227*)
Delrad		307.2 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
PBA, dimethylamine		10 lb	Granules	70 percent	Treated June 5, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	100 percent	do	(*248*)
		40 lb	do	do	do	(*248*)
2,3,6 TBA, sodium salt		10 lb	Granules	60 percent	Treated June 5, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	70 percent	do	(*248*)
		40 lb	do	90 percent	do	(*248*)
CIPC		10 lb	Granules	20 percent	Treated July 18, checked Sept. 18, drainage ditch, Ark.	(*248*)
		20 lb	do	40 percent	do	(*248*)
		40 lb	do	60 percent	do	(*248*)
Kerosene	5		Water	Only partial	Beaker tests, excised plants, 30-minute contact.	(*181*)
	50		do	do	do	(*181*)
	100		do	do	do	(*181*)
	200		do	do	do	(*181*)
	400		do	do	do	(*181*)
	800		do	do	do	(*181*)
Benzene	5		Water	Only partial	Beaker tests, excised plants, 30-minute contact.	(*181*)
	50		do	do	do	(*181*)
	100		do	do	do	(*181*)
	200		do	do	do	(*181*)
	400		do	Good	do	(*181*)
	800		do	do	do	(*181*)
Monochlorobenzene	5		Water	Good	Beaker tests, excised plants, 30-minute contact.	(*181*)
	50		do	do	do	(*181*)
	100		do	do	do	(*181*)
	200		do	Complete	Beaker tests, 30-minute contact, 6 weeks.	(*181*)
	400		do	do	do	(*181*)
	800		do	do	do	(*181*)

Dichlorobenzene	5		Water	Complete	Beaker tests, 30-minute contact, 6 weeks.	(181)
	50		do	do	do	(181)
	100		do	do	do	(181)
	200		do	do	do	(181)
	400		do	do	do	(181)
	800		do	do	do	(181)
Trichlorobenzene	5		Water	Partial	Beaker tests, 30-minute contact, 6 weeks.	(181)
	50		do	Very good	do	(181)
	100		do	Complete	do	(181)
	200		do	do	do	(181)
	400		do	do	do	(181)
	800		do	do	do	(181)
Polychlorobenzene	5		Water	Partial	Beaker tests, 30-minute contact, 6 weeks.	(181)
	50		do	Very poor	do	(181)
	100		do	Very good	do	(181)
	200		do	Very poor	do	(181)
	400		do	Very good	do	(181)
	800		do	Complete	do	(181)
Toluene	5		Water	Good	Beaker tests, 30-minute contact, 6 weeks.	(181)
	50		do	Poor	do	(181)
	100		do	Good	do	(181)
	200		do	do	do	(181)
	400		do	Complete	do	(181)
	800		do	do	do	(181)
Xylene	5		Water	Poor	Beaker tests, 30-minute contact, 6 weeks.	(181)
	50		do	Complete	do	(181)
	100		do	do	do	(181)
	200		do	do	do	(181)
	400		do	do	do	(181)
	800		do	do	do	(181)
		253.3 gal		None	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(181)
Trimethyl benzene	5		Water	Partial	Beaker tests, 30-minute contact, 6 weeks.	(181)
	50		do	do	do	(181)
	100		do	Complete	do	(181)
	200		do	Good	do	(181)
	400		do	Complete	do	(181)
	800		do	do	do	(181)
Commercial #1	5		Water	Partial	Beaker tests, 30-minute contact, 6 weeks.	(181)
	50		do	do	do	(181)
	100		do	do	do	(181)
	200		do	do	do	(181)
	400		do	do	do	(181)
	800		do	do	do	(181)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Potamogeton foliosus (Leafy pondweed)—Continued						
	P.p.m.[1]					
Commercial #2	5		Water	Partial	Beaker tests, 30-minute contact, 6 weeks.	(*181*)
	50		do	do	do	(*181*)
	100		do	do	do	(*181*)
	200		do	Good	do	(*181*)
	400		do	do	do	(*181*)
	800		do	Partial	do	(*181*)
Na PCP		154.4 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
Potamogeton natans (Pondweeds)						
2,4-D	1.5	10 lb	Granules	Partial; regrowth in 1 month.	Pond tests, N.Y	(*192*)
Silvex, PGBEE	1.2			None	do	(*191*)
Copper sulfate		500 lb		90 percent	Ponds tests, N.J	(*159*)
Potamogeton nodosus (*P. americanus*) (American pondweed)						
2,4-D		12 lb		95-percent kill	30-minute contact	(*180*)
2,4-D, IPE		26.2 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
		23.1 lb		do	do	(*181*)
		21.6 lb		do	do	(*181*)
		18.7 lb		90 percent	do	(*181*)
		16.8 lb		95 percent	do	(*181*)
		13.6 lb		do	do	(*181*)
		11.8 lb		do	do	(*181*)
		11.4 lb		do	do	(*181*)
		9.4 lb		85 percent	do	(*181*)
		9.2 lb		75 percent	do	(*181*)
2,4-D, Na salt	80.1		Granules	100 percent	10 months, tank covered with Spirogyra.	(*181*)
2,4-D, TBP		10 lb		No regrowth	Sprayed on dry pond bottom	(*231*)
		10 lb		None	Applied to filled pond	(*231*)
Monuron		21.5 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
	Less than 10			Killed	Irrigation channels	(*180*)
MH	7.4		Granules	100 percent	10 months	(*181*)
		16.8 lb		None	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
AMS		1 lb./gal./100 sq. ft.	Water + Vatsol OS.	Killed leaves	Pond tests	(*103*)

Aromatic solvent	740	10 gal./c.f.s		Needed for control	Irrigation channels, to 5 miles for 8 weeks, 30-minute contact.	(*117*)
Copper sulfate		492 lb		60 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
Sodium arsenite	2.5–4				Recommended rate	(*188*)
	2.5				Ponds; recommended rate	(*232*)
	1.7–2			Killed	Pond tests	(*230*)
Delrad	66.3		Granules	None	10 months	(*181*)
	50		do	100-percent tops; complete regrowth.	do	(*181*)
		658.1 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
BHC (α)		1,277.6 lb		95 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
Sodium borate	350–650			Killed	Irrigation channels	(*180*)
	458		Granules	do	10 months	(*181*)
Potamogeton pectinatus (*P. pectinatus* var. *interruptus*) (Sago pondweed)						
2,4-D		15 lb		90-percent kill	30-minute contact	(*180*)
2,4-D, acid	144.4		Granules	100 percent	10 months, replaced by Spirogyra.	(*181*)
	20		do	do	10 months	(*181*)
		38.4 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
2,4-D, IPE		38.1 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
		33.1 lb		do	do	(*181*)
		22.5 lb		95 percent	do	(*181*)
		21.6 lb		do	do	(*181*)
		20.4 lb		do	do	(*181*)
		17.5 lb		do	do	(*181*)
		16.6 lb		90 percent	do	(*181*)
		15.7 lb		do	do	(*181*)
		13.6 lb		95 percent	do	(*181*)
		11.4 lb		80 percent	do	(*181*)
		11.3 lb		85 percent	do	(*181*)
		10.8 lb		95 percent	do	(*181*)
		10.6 lb		80 percent	do	(*181*)
		8.1 lb		90 percent	do	(*181*)
		5.5 lb		70 percent	do	(*181*)
2,4-D, Na salt	76.6		Granules	100 percent	10 months, some blue-green algae.	(*181*)
	25		do	do	10 months	(*181*)
Monuron	Less than 10			Killed	Irrigation channels	(*180*)
	8.3		Granules	100 percent	10 months	(*181*)
	9.2		do	do	do	(*181*)
		50 lb		Resistant	Pond tests, N.J	(*159*)
		75 lb		do		(*159*)
		100 lb		do		(*159*)

See footnotes at end of table, p. 69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Potamogeton pectinatus (*P. pectinatus* var. *interruptus*) (Sago pondweed)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.[1]					
Endothal	24			25-percent kill	Rooted plants, 30-minute contact.	(*102*)
	60			60-percent kill	do	(*102*)
	50			100-percent kill	Rooted plants, 4-day contact	(*102*)
	240			99-percent kill	Rooted plants, 30-minute contact.	(*102*)
	240			100-percent kill	do	(*102*)
	120			do	Rooted plants, 60-minute contact.	(*102*)
	240			do	do	(*102*)
	480			do	do	(*102*)
	960			do	do	(*102*)
	1			99 percent	Rooted plants, 3-week contact, 5 weeks to 3 months.	(*181*)
	2.5			100 percent	do	(*181*)
	5			do	do	(*181*)
	10			do	do	(*181*)
	15			98 percent	Rooted plants, 4-hour contact, 5 weeks to 3 months.	(*181*)
	2.5			do	Rooted plants, 24-hour contact, 5 weeks to 3 months.	(*181*)
	25			100 percent	do	(*181*)
Simazine		10 to 26 lb		Partial; regrowth in 3 weeks to 2 months.	Drained irrigation ditch	(*135*)
Aromatic solvent	600	8.1 gal./c.f.s		Needed for control	Irrigation channels, 30-minute contact, 8 weeks.	(*117*)
	740	10 gal./c.f.s		do	do	(*117*)
	300			Satisfactory	Irrigation channels, 30-minute contact.	(*239*)
Benoclor 3C	300			Intermediate	Irrigation channels, 1-hour contact.	(*125*)
Coal tar naphtha solvent		577.1 gal		None	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
Copper sulfate		333.7 lb		None	do	(*181*)
		196.6 lb		do	do	(*181*)
		300 lb		Resistant	Pond tests, N.J	(*159*)
		500 lb		do	do	(*159*)
Sodium arsenite	1.7–2			Killed	Pond tests	(*230*)
		517.1 lb		75 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
Delrad	59.3		Granules	30 percent; 70-percent regrowth.	10 months	(*180*)
	26.6		do	None; 100-percent regrowth.		(*181*)
	100		do	98-percent top kill; 100-percent regrowth.		(*181*)
Na PCP		432.2 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)

Sodium borate	427		Granules	do	10 months, 100-percent cover of horned pondweed.	(181)
	350–650			Killed	Irrigation channels	(180)
Potamogeton pusillus (Pondweed)						
Monuron	4.6	25 lb		90 percent	Pond tests, N.J	(159)
	9.2	50 lb		95 percent	do	(159)
	15.4	100 lb		100 percent	do	(159)
Copper sulfate		300 lb		90 percent	Pond tests, N.J	(159)
		500 lb		do	do	(159)
Potamogeton richardsonii (Richardson's pondweed)						
2,4-D		7 lb		85-percent kill	30-minute contact	(180)
2,4-D, IPE		54.1 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(181)
		41.7 lb		do	do	(181)
		37.5 lb			do	(181)
		27.1 lb		95 percent	do	(181)
		22.6 lb		90 percent	do	(181)
		15.1 lb		85 percent	do	(181)
		12 lb		100 percent	do	(181)
		11.3 lb		95 percent	do	(181)
		9.3 lb		100 percent	do	(181)
		7.1 lb		do	do	(181)
		6.1 lb		50 percent	do	(181)
		5.9 lb		10 percent	do	(181)
		5.5 lb		40 percent	do	(181)
		4.6 lb		30 percent	do	(181)
2,4-D, Na salt	114			100 percent	10 months, 100-percent cover of Spirogyra.	(181)
Monuron	Less than 10			Killed	Irrigation channel	(180)
Aromatic solvent	740	10 gal./c.f.s		Needed for control	Irrigation channel, 30-minute contact.	(117)
	300			Satisfactory	Irrigation channels, 30-minute contact.	(239)
Copper sulfate		300 lb		90 percent	Pond tests, N.J	(159)
Sodium chlorate		2,507.1 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(181)
Sodium borate	350–650			Killed	Irrigation channel	(180)
	643			Killed; regrowth stunted.	10 months	(181)
Potamogeton robbinsii (Pondweed)						
2,4-D	1.5	10 lb	Granules	Partial; regrowth in 1 month.	Pond tests, N.Y	(192)
Silvex, PGBEE	1.2			None	do	(191)
Monuron		75 lb		95 percent	Pond tests, N.J	(159)
		100 lb		do	do	(159)
Copper sulfate		400 lb		90 percent	Pond tests, N.J	(159)
		500 lb		do	do	(159)

See footnotes at end of table, p.69.

TABLE 9.—*Effects of certain aquatic herbicides on submerged weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Potamogeton spirillus (Pondweed)						
	P.p.m.[1]					
2,4,5-T		100 gal	Diesel fuel	Good kill	Sprayed on dewatered pond area.	(2)
AMS		1 lb./gal./200 sq. ft.		Poor	Pond tests	(2)
Potamogeton vaseyi (Pondweed)						
Monuron		75 lb		95 percent	Pond tests, N.J	(*159*)
		100 lb		do	do	(*159*)
Copper sulfate		400 lb		90 percent	Pond tests, N.J	(*159*)
		500 lb		do	do	(*159*)
Utricularia spp. (Bladderworts)						
2,4-D		20 lb	Granules	None	Pond tests, N.Y	(*192*)
2,4-D, IOE		20 lb	do	75 percent	Pond tests, Ga., 1959	(*211*)
		86 lb	do	100 percent; no regrowth 2d year.	Pond tests, Ga., treated 1958	(*211*)
		40 lb	do	do	Broadcast application, pond tests, Ga.	(*236*)
2,4,5-T, amine		4 lb	Water, 80 gal	75 percent	Spray application, pond tests, Ga.	(*236*)
Silvex	2.5–3			Satisfactory	Research trials, N.J	(*97*)
	0.3–0.5			80–90 percent	Pond tests	(*123*)
	2			50 percent	Gravity-flow application, pond tests, Ga.	(*236*)
		4 lb	Water, 80 gal	100 percent	Spray application, pond tests, Ga.	(*236*)
	1			do	Gravity-flow application, pond tests, Ga.	(*236*)
Silvex, PGBEE	1			50–100 percent	Pond tests, Ga., 1959	(*211*)
	1.2			Partial; only checked growth.	Pond tests, N.Y	(*191*)
Erbon	2–2.5			Killed	Pond test	(*251*)
Benoclor 3C		750 gal./35 acres + 700 gal./25 acres.		Satisfactory	Pond test, N.Y	(*246*)
Sodium arsenite	4			Partial kill	Pond tests	(2)
	2.5				Ponds; recommended rate	(*232*)
	6			100 percent	Pond tests, Ga., 1959	(*235*)
	4			do	Gravity-flow application, pond tests, Ga.	(*236*)
Chlorea		860 lb		None; regrowth 2d year.	Pond tests, Ga., treated 1958	(*235*)
	8		Granules	None	Broadcast application, pond tests, Ga.	(*236*)
		860 lb	do	do	do	(*236*)

Esso WS-1492		20 gal		100 percent; some regrowth in 3.5 months.		(*224*)
Vallisneria americana (*V. spiralis*) (Eelgrass)						
Silvex	0.5			None	Pond tests, N.J., 4 weeks	(*252*)
	2.5			95–100 percent	do	(*252*)
	.3			50 percent	Pond tests	(*123*)
	.5			Unsatisfactory	As spray, research trials, N.J.	(*97*)
Monuron		400 lb		Nontoxic	Pond tests, N.J	(*159*)
		75 lb		Resistant	do	(*159*)
		100 lb		do	do	(*159*)
Copper sulfate		300 lb		90 percent	Pond tests, N.J.; 8 percent maximum area treated at one time.	(*159*)
		500 lb		do	Pond tests, N.J	(*159*)
Delrad 70	1			Unsatisfactory	Research trials, N.J	(*97*)
Sodium chlorate		200 lb	Water, 200 gal	Killed tops; regrowth in 2 weeks.	In pond, resprayed in 3 days	(*168*)
Zannichellia palustris (Horned pondweed)						
2,4-D		7 lb. or less		Complete kill	30-minute contact	(*181*)
2, 4-D, IPE		13.5 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
		12.4 lb		do	do	(*181*)
		10.8 lb		do	do	(*181*)
		7.2 lb		do	do	(*181*)
Na TCA		328.5 lb		100 percent	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
Monuron	Less than 10			Killed	Irrigation channel	(*180*)
Aromatic solvent	400	5.5 to 5.9 gal./c.f.s.		Needed for control	Irrigation channels, from ¾ to 1½ miles, 5–6 weeks.	(*117*)
	600	8.1 gal./c.f.s		do	Irrigation channels, 8 weeks	(*117*)
	740	10 gal./c.f.s		do	Irrigation channels, up to 5 miles.	(*117*)
	300			Satisfactory	Irrigation channels, 30-minute contact.	(*239*)
Benoclor 3C	300			Effective	Irrigation channels, 1-hour contact.	(*125*)
Copper sulfate		447 lb		None	Greenhouse tests, 2- to 6-hour exposure, 6 weeks.	(*181*)
		356.1 lb		60 percent	do	(*181*)
Sodium arsenite	2.5–4				Recommended rate	(*188*)

[1] Except as indicated.
[2] AUBURN UNIVERSITY. DATA ON CHEMICAL WEED CONTROL IN PONDS. Ala. Agr. Expt. Sta., Farm Ponds Proj., Unpublished Ann. Rpts. 1946–61.
[3] Personal correspondence from T. W. Wright. 1958.
[4] Personal communication from C. W. Wilde, Bd. Fisheries and Game, Conn. 1957.

TABLE 10.—*Effects of certain aquatic herbicides on emergent weeds*

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Brasenia schrebari (Watershield)						
	P.p.m.					
2,4-D, amine		4 lb	Water (1:100)	50 percent	Treated July 25, Ky	(*225*)
		3 lb	Water (1:80)	None; 100-percent regrowth following year.	Pond tests, Ga., 1958	(*235*)
2,4-D	1.5	10 lb	Granules	Killed; some regrowth within 1 month.	Pond tests, N.Y	(*192*)
2,4-D, Dowanol		10 lb	do	20 percent	Pond, pH 6.8–7.0	(*211*)
		20 lb	do	100 percent	Lake, pH 5.5	(*211*)
2,4-D, PGBEE		4.8 lb	Diesel fuel	90–100 percent	Pond tests	(*210*)
2,4-D, BE		6 to 8 lb	do	Good	do	([2])
2,4-D- IOE		240 lb	Granules	90 percent; regrowth 2d year.	Broadcast application, pond tests, Ga.	(*236*)
		10, 15, 20 lb	do	60–100 percent; regrowth 25-100 percent same year.	Pond tests, Ga., 1959	(*235*)
2,4-D, IPE		6 to 8 lb	Diesel fuel	Fair	Pond tests	([2])
2,4-D+2,4,5-T		4 lb	Water, 80 gal	100 percent	Spray application, 2 ponds, Ga.	(*236*)
2,4,5-T, ester		4 lb	do	do	do	(*236*)
2,4,5-T		4 lb	do	95 percent	do	(*236*)
Silvex		16 lb	do	100 percent	do	(*237*)
		4 lb. (each)		Satisfactory	Research trials, 2 applications, N.Y.	(*97*)
	.5			100 percent	Pond tests, Mass., treated July 15.	(*123*)
Silvex, PGBEE	2			100 percent; no regrowth in 2d year.	Pond tests, Ga., treated 1958	(*211*)
		1.5, 3 lb	Water	75–100 percent	4 pond tests, Ga., 1959	(*211*)
Silvex, acid, Na salt, PGBEE		10 lb	Granules	82 percent	Pond, pH 6.8–7.0	(*211*)
		20 lb	do	100 percent	Lake, pH 5.5	(*211*)
Dalapon		16 lb	Water, 80 gal	None	Spray application, 2 ponds, Ga.	(*236*)
		10 lb	Water	Resistant	Pond tests	(*210*)
Monuron		75 lb		Resistant	Pond tests, N.J	(*159*)
		100 lb		do	do	(*159*)
MH		20 lb		100-percent top kill; regrowth in 3 months.	Refuge trials	(*224*)
Amitrole		20 lb	Water		Based on pond tests; recommended rate.	(*210*)
Erbon		8 lb	Water, 80 gal	25 percent	Spray application, 2 ponds, Ga.	(*236*)
Benoclor 3C		20 gal		100-percent top kill; regrowth in 3.5 months.		(*224*)
Copper sulfate		400 lb		Resistant	Pond tests, N.J	(*226*)
		500 lb		do	do	(*226*)
Sodium arsenite	5			None	Pond tests	(*170*)

Chloroben		750 gal./35 acres +700 gal./25 acres.		Satisfactory	Pond tests, N.Y.	(246)
Ludwigia palustris (Waterpurslane)						
Monuron	10			Killed	Pond tests, Oreg.	(109)
Sodium arsenite	3.4				Ponds; recommended rate	(232)
Nasturtium officinale (Watercress)						
2,4-D		16 lb			Ponds; recommended rate	(232)
2,4-D, free acid	223.7		Granules	100 percent		(181)
2,4-D, IPE		3 lb		do	Irrigation channels	(180)
Diuron	15.8		Granules	do		(181)
DCB	4–6			No effect	Irrigation channels	(124)
Borascu	736			75 percent	do	(180)
Delrad	13			Eliminated	do	(180)
	39.9		Granules	75 percent; 25-percent regrowth.	75-percent Spirogyra, greenhouse tests, 10 months.	(181)
	12.8			100 percent; replaced by Spirogyra.	Greenhouse tests, 10 months	(181)
Monuron (CMU)	10–19			Killed	Dewatered area	(180)
Sodium borate	736		Granules	100 percent		(181)
Nuphar advena (Spatterdock)						
2,4-D+wetting agent		12 lb. (each)	Water + Tween 20.	Poor	1st series, 1 application in Mar., 2d series, 2 applications Apr. and July.	(240)
		12 lb. (each)	Du Pont W-S+ water.	do	do	(240)
2,4-D		12 lb. (each)	Water	Poor	1st series, 1 application in Mar., 2d series, 2 applications Apr. and July.	(240)
	10			Effective	Greenhouse tests, regrowth retreated.	(198)
		20, 40 lb	Granules	80, 90 percent; took 7 weeks.	Fla	(211)
		8 lb	Oil	Unsatisfactory		(174)
		5 lb (each)	Water	do	2 treatments	(174)
		5 lb (each)	do	do	4–6 treatments over 2–3 years	(174)
		4 to 8 lb	Oil		Ponds; recommended rate	(232)
2,4-D, Dowanol		20 lb	Granules	80 percent	Lake, pH 5.5	(211)
2,4-D		43.6 lb	do	2 percent	Treated Mar. 5, 1958, Fla	(121)
		21.8 lb	do	None	Treated Mar. 25, 1958, Fla	(121)
2,4-D, ester		4.2 lb	Kerosene	3 percent	Treated Aug. 26, 1957, Fla	(121)
		8.4 lb	Water+Tide	None	Treated Dec. 17, 1957, Fla	(121)
2,4-D, TEA		8 to 12 lb	Kerosene	Killed leaves	Pond tests	(234)
2,4-D, TBP		8 to 12 lb	do	do	do	(234)
2,4-D+AMS		5 lb.+75 lb	Water	95 percent	AMS applied 1 month after 2,4-D.	(174)
		4 lb.+75 lb	Water+detergent		AMS applied 1 month after 2,4-D; recommended rate.	(215)

See footnotes at end of table, p. 78.

TABLE 10.—*Effects of certain aquatic herbicides on emergent weeds*—Continued

Nuphar advena (Spatterdock)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.					
2,4-D, PGBEE		20, 40 lb	Granules	40 and 90 percent; took 7 weeks.	Fla	(*211*)
2,4-D, BEE (invert.)		10 lb	Kerosene + water	3 percent	Treated June 12, 1958, Fla	(*121*)
2,4-D, BE		5 lb	Water	Poor to 90 percent		(*174*)
		4 to 8 lb	do	Good kill	Pond tests	(*149*)
		2 to 4 lb	do	Good	do	(*149*)
2,4-D, IPE		3.34 lb	Oil, 4 gal	None	20 acres, air treatment, Fla	(*211*)
2,4-D + 2,4,5-T		10 lb	Kerosene	5 percent	Treated Aug. 26, 1957, Fla	(*121*)
		5 lb	do	3 percent	Treated Sept. 4, 1957, Fla	(*121*)
2,4,5-T		21.8 lb	Granules	3 percent	Treated Mar. 25, 1958, Fla	(*121*)
Silvex		4 lb. (each)	Water	Satisfactory	Research trials, N.J., 2 applications.	(*97*)
	1–2.5			do	Research trials, N.J	(*97*)
	.5			100 percent	Pond tests, Mass	(*123*)
	2			Satisfactory	Pond tests, NE	(*148*)
Silvex, PGBEE		20 lb	Water + Tide	5–10 percent	Treated Apr. 25, 1958, Fla	(*121*)
		80 lb	Water	70 percent	Treated Aug. 1, 1958, Fla	(*121*)
	1.2			Killed	Pond tests, N.Y	(*177*)
		20, 40 lb	Granules	50–80 percent; after 7 weeks.	Fla	(*211*)
	2		Undiluted	50 percent	Injected into water, Fla	(*211*)
Silvex, acid, Na salt, PGBEE		20 lb	Granules	80 percent	Lake, pH 5.5	(*211*)
Dalapon		20 lb	Water, 11 gal	Unsatisfactory	Research trials in field	(*99*)
		20 lb	Water	Ineffective	Research trials, SE	(*99*)
Monuron	100			90 percent	Pond tests, N.J	(*159*)
AMS		150 lb	Detergent	Killed tops; regrowth from roots.	Pond tests	(*103*)
Copper sulfate		400 lb		Resistant	Pond tests, N.J	(*159*)
		500 lb		do	do	(*159*)
Sodium arsenite	50			Partial	Greenhouse tests, 42 days	(*198*)
HCA		160 lb	Water	None	Treated Sept. 4, 1957, Fla	(*121*)
Aqua San + 2,4-D		25 lb	do	do	Treated Feb. 7, 1958, Fla	(*121*)
Altacide + 2,4-D		10 lb	do	2 percent	do	(*121*)
Granular chlorea		454 lb		do	Treated Apr. 7, 1958, Fla	(*121*)
		499 lb		do	do	(*121*)
Veon 100		10 lb	Water + Tide	3 percent	Treated Apr. 25, 1958, Fla	(*121*)
Ammonium thiocyanate	100			Ineffective	Greenhouse tests, 28 days	(*198*)

Nymphaea spp. (Waterlilies)

	1.5–3.1	10 to 20 lb	Granules	100 percent; good for 1 season.	Pond tests, N.Y	(*192*)
		2 lb			Wetting agent, (white waterlilies); trial use suggested.	(*169*)
2,4-D		8 lb	Oil		Ponds; recommended rate	(*232*)
		400 lb	10 percent granules.	Practically eradicated	Pond tests, Mass., 1 year	(*119*)
		100 lb	20 percent granules.	Retarded		(*197*)

2,4-D, PGBEE		4.8 lb	Diesel fuel	90–100 percent	Pond tests	(210)
2,4-D, TBP		8 to 12 lb	Kerosene	Killed	2 resprays on regrowth in 15 days (banana waterlilies).	(122)
Silvex	0. 2, 0. 5, 0. 8			100 percent	Pond tests, Mass., treated in July or Sept.	(123)
	1				Dow Chem. Trial use suggested.	(169)
Silvex, PGBEE	1. 2		Water	Killed	Pond tests, N.Y	(191)
Amitrole		4 to 12 lb			Trial use suggested (yellow waterlilies).	(169)
Erbon	2				Dow Chem. Trial use suggested.	(169)
	. 5			Killed	Pond tests, 21 days (yellow waterlilies).	(251)
	1.			do	Pond tests, 21 days (white waterlilies).	(251)
Benoclor 3C		750 gal./35 acres +700 gal./25 acres.		Satisfactory	Pond test, N.Y	(246)
Copper sulfate	3			None	Pond tests (white and yellow waterlilies).	(118)
	3			do	Pond tests	(206)
Sodium arsenite	5			None	Pond tests	(170)
Mixed trichlorobenzoic acid		6 lb. or more			Trial use suggested	(169)
Nymphaea mexicana, odorata, tuberosa (White waterlily)						
2,4-D		8 lb		Eradicated	Repeated spraying for 2 or more years.	(174)
2,4-D, BE		4 lb	Kerosene	Killed leaves; some regrowth.	Pond tests	(231)
		4 lb	Water	Killed leaves	do	(2)
		8 lb	do	do	do	(2)
		8 lb	Diesel fuel	do	do	(2)
		8 to 12 lb	Water	Good	do	(149)
2,4-D, IPE		4 to 8 lb	Diesel fuel	90–100 percent	Pond tests	(210)
2,4-D, Na salt		4 to 8 lb	Water	Killed leaves	do	(2)
Dalapon		10 lb	do	Resistant	do	(210)
Amitrole		20 lb	do		Based on pond tests; recommended rate.	(210)
AMS		10 lb	do	Killed some leaves	Pond tests	(231)
Sodium arsenite	16			No kill of roots	do	(230)
Nymphaea odorata (White waterlily)						
2,4-D, invert		4 lb		None	Treated July 10, checked Oct. 1, refuge.	(242)
		8 lb		do	do	(242)
2,4-D, amine	0. 7			100 percent	Pond tests, Ga	(235)
2,4-D, ester		3.34 lb	Water, 100 gal	75 percent	Treated Aug. 13, sprayed, Ga	(226)
2,4-D		15 lb	Water	60 percent	Refuge research trials	(240)

See footnotes of end of table, p. 78.

TABLE 10.—*Effects of certain aquatic herbicides on emergent weeds*—Continued

Nymphaea odorata (White waterlily)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.					
2,4-D + wetting agent		4 to 12 lb	Water + Tween 20 (3%).	Fair	Applied in Apr	(*240*)
		4 to 12 lb	Water + Du Pont W-S.	do	do	(*240*)
		8 lb	Water + Tween 20	do	Applied in Aug	(*224*)
		8 lb	Water + Du Pont W-S.	do	do	(*224*)
		2 lb	Water + Tween 20.	95 percent	Sprayed from May to Aug., Brasenia not killed.	(*223*)
		2 lb	Water + Du Pont W-S.	do	do	(*223*)
		2 lb	Water + Tergitol	do	do	(*223*)
		2 lb	do	90 percent	do	(*223*)
2,4-D		2 lb	Water	95–100 percent	Sprayed from May to Aug., Brasenia not killed.	(*223*)
2,4-D, IOE		39.9 lb	Granules	90 percent	Treated Aug. 7, checked, Oct. 1, refuge.	(*242*)
		99.7 lb	do	98 percent	do	(*242*)
		15, 20 lb	do	100 percent	Pond tests, Ga., 1959	(*235*)
		5 lb	do	do	Spray application, pond tests, Ga.	(*236*)
		20 lb	do	50 percent	do	(*236*)
2,4-D, IPE		3.34 lb. (each)	Oil	95 percent tops, 0 percent roots.	3 air treatments, Fla	(*211*)
		3.34 lb	do	100 percent tops, 95 percent roots.	1 air treatment, Fla	(*211*)
2,4-D + 2,4,5-T		4 lb	Water, 80 gal	100 percent	Spray application, pond tests, Ga.	(*236*)
2,4-D + 2,4,5-T + dalapon + Tide.		3 lb. + 7.5 lb. + 3 lb.	Water, 80 gal	do	do	(*236*)
		3 lb. + 15 lb. + 3 lb.	do	do	do	(*236*)
		6 lb. + 15 lb. + 3 lb.	do	do	do	(*236*)
2,4,5-T		4 lb	Water, 80 gal	100 percent	Spray application, pond tests, Ga.	(*236*)
2,4,5-T, BEE	.3		Water (1:40)	100 percent; 99-percent regrowth same year.	Pond test, Ga., 1959	(*235*)
Silvex, invert		4 lb		None	Treated July 10, checked Oct. 1, refuge.	(*242*)
		8 lb		do	do	(*242*)

Silvex	----------	8 lb	Water, 80 gal	100 percent	Spray application, pond tests, Ga.	(236)
	----------	4 lb	do	do	do	(236)
	----------	6 lb	Water	90+ percent	Sprayed on leaves, 4 weeks, pond tests, N.J.	(189)
	----------	4 lb	----------	Satisfactory	Research trials, N.Y	(97)
	0.5–2.5	----------	----------	do	Research trials, N.J	(97)
	.5	----------	----------	Partial	Pond tests, N.J	(252)
	2	----------	----------	95–100 percent	do	(252)
	2.5	----------	----------	do	do	(252)
	3	----------	----------	do	do	(252)
Silvex, PGBEE	----------	2.5 lb	Water (1:160)	100 percent	Pond tests, Ga	(235)
	2	----------	Water	do	do	(235)
Dalapon	----------	5 to 20 lb	Water	None	Treated July 28, plants in bloom.	(241)
Dalapon + erbon	----------	15 lb. + 6 lb	Water, 80 gal	50 percent	Spray application, pond tests, Ga.	(236)
MH	----------	15 lb	Water	40 percent	Refuge research trials, S.C	(224)
	----------	20 lb	do	100-percent top kill; short control, regrowth in 3 months.	----------	(224)
	2	----------	----------	Unsatisfactory	Research trials, spray, N.J	(97)
Erbon	----------	80 to 160 lb	Water	Erratic	Treated May 11, ditch test	(241)
	----------	6 lb	Water, 80 gal	25 percent	Spray application, pond tests, Ga.	(236)
	----------	8 lb	do	100 percent	do	(236)
	----------	2 lb	do	50 percent	do	(236)
Simazine	----------	50 lb	Water (1:5)	100 percent	Pond test, Ga., 1959	(235)
	----------	150 lb	Granules	10 percent	do	(235)
Benoclor 3C	----------	20 gal	----------	100-percent top kill; regrowth in 3.5 months.	----------	(149)
2,3,6 TBA	----------	1.5 lb	Water	Fair	Treated June 23, plants in bloom, young growth.	(241)
	----------	6 to 30 lb	do	Complete kill	do	(241)
	----------	1.5 to 12 lb	do	Ineffective	Treated May 31, older growth	(241)
	----------	1.5 to 3 lb	----------	Fair to good	Plants less than 1 year old	(241)
	----------	6 to 30 lb	----------	100 percent	do	(241)
Esso WS–1492	----------	20 gal	----------	100-percent top kill; regrowth in 3 months.	Wildlife refuge	(224)
Oenanthe sp. (Waterparsley)						
Monuron	10	----------	----------	Killed	Pond tests, Oreg	(109)
Peltandra virginica (Arrow-arum)						
2,4-D, BE	----------	8 to 12 lb	Water	Good	Pond tests	(149)
Silvex	----------	80 to 160 lb	do	Erratic	Treated May 17, field tests, Ga.	(101)

See footnotes at end of table, p. 78.

TABLE 10.—*Effects of certain aquatic herbicides on emergent weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
		Pistia stratiotes (Waterlettuce)				
	P.p.m.					
2,4-D, esters		8 to 12 lb	Oil		Recommended rate	(*211*)
2,4-D, invert., PGBEE		13.3 lb		90 percent	Tests in Fla	(*211*)
2,4-D, invert., BEE		4.8 lb	Kerosene+water	1–2 percent	Treated July 28, 1958, Fla	(*121*)
		10 lb	do	80 percent	Treated June 16, 1958, Fla	(*121*)
		10 to 15 lb	Water	80 percent; mature plants killed.	Fla	(*211*)
2,4-D, alkanolamine		8 to 10 lb	Water	None; slight necrosis	Fla	(*211*)
MCPA		4 lb		60 percent; regrowth in 6 weeks.		(*211*)
2,4,5-T, invert., PGBEE		10 to 15 lb		70–90 percent	Tests in Fla	(*211*)
2,4,5-T, invert., BEE		20 lb		20 percent	do	(*211*)
Silvex, invert., BEE		13.3 to 20 lb		70–90 percent	do	(*211*)
Simazine		5 to 35 lb	Water		Recommended rate; India trials.	(*211*)
Simazine (WP)		20 to 25 lb		50–100 percent	Tests in Fla	(*211*)
Atrazine (WP)		20 lb		80 percent	do	(*211*)
Diquat		3 to 5 lb		100 percent; rapid kill.	do	(*211*)
Aqua San+2,4-D		20 lb	Water	8 percent	Treated Mar. 18, 1958, Fla	(*121*)
		20 lb	do	5 percent	Treated Mar. 26, 1958, Fla	(*121*)
Aqua San		32 lb	Water	2 percent	Treated Apr. 25, 1958, Fla	(*121*)
		Ranunculus aquatilis (White watercrowfoot)				
Monuron	10			Killed	Pond tests, Oreg	(*109*)
Diuron	2.5			do	do	(*109*)
Aromatic solvent	300–400			Needed for control	Irrigation channels, 30-minute contact.	(*117*)
Sodium arsenite	3				Ponds; recommended rate	(*232*)
		Rorippa spp.				
Diuron	10			Killed	Pond tests, Oreg	(*109*)
		Trapa natans (Waterchestnut)				
2,4-D, amine		8 lb	Kerosene+water, 22 gals.	Satisfactory	Field tests, N.J	(*97*)
2,4-D, acetamide		2 lb	Wettable powder	Good	Treated in July, checked in Sept., N.Y.	(*142*)
		4 lb	do	do	do	(*142*)
		8 lb	do	Very good	do	(*142*)

2,4-D, amine salt		2 lb	Kerosene + Water + Ige pal CO 530.	Very good	Treated in July, checked in Sept.	(142)
		4 lb	do	Good	do	(142)
		8 lb	do	do	do	(142)
		8 lb	Water, 50 gal		Recommended rate	(207)
2,4-D, salt		8 lb	Water, 50 gal	100-percent kill	2-percent concentration	(174)
2,4-D, ester		8 lb	Water, 50 gal	100-percent kill	do	(174)
		4 lb	Diesel fuel, 50 gal.	Very effective		(174)
2,4-dichloroisobutyric acid		10 lb	Water, 50 gal	None	Treated in July, checked in Sept., N.Y.	(142)
2,4-D, BEE		2 lb	Water, 50 gal	Good	Treated in July, checked in Sept., N.Y. and Md.	(142)
		4 lb	do	Very good	do	(142)
		8 lb	do	Complete	do	(142)
		2 lb	Kerosene	Good	Treated in July, checked in Sept., N.Y.	(142)
		4 lb	do	do	do	(142)
		8 lb	do	Very good	do	(142)
		4 lb	Granules (8–15 mesh).	None	Treated in May; Md., N.Y., and Vt.	(142)
		8 lb	do	do	do	(142)
		12 lb	do	do	do	(142)
		16 lb	do	Slight	do	(142)
		20 lb	do	do	do	(142)
		40 lb	do	Excellent	do	(142)
2,4-D, butoxy ethanol, invert		1 lb	Water	Partial	Treated in July, checked in Sept., N.Y.	(142)
		2 lb	do	do	do	(142)
		4 lb	do	do	do	(142)
		8 lb	do	do	do	(142)
2,4-D, isopropanolamine		5 lb	Granules	Effective	Field tests, NE	(141)
2,4-D, diethanolamine + 2,4,5-T, TEA.		4 lb	Granules (8–15 mesh).	Excellent	Treated in July, checked in Sept., N.Y.	(142)
		8 lb	do	do	do	(142)
		12 lb	do	do	do	(142)
		16 lb	do	do	do	(142)
MCPA		2 lb	Water	Good	Treated in July, checked in in Sept., N.Y.	(142)
		4 lb	do	do	do	(142)
		8 lb	do	do	do	(142)
2,4,5-T, invert		5 lb	Water	Partial	Treated in July, checked in Sept., N.Y.	(142)
		1 lb	do	do	do	(142)
		2 lb	do	do	do	(142)
		4 lb	do	do	do	(142)
Silvex		2 lb	Granules	None	Treated in May, N.Y	(142)
		4 lb	do	do	do	(142)
		8 lb	do	do	do	(142)
		12 lb	do	do	do	(142)
		16 lb	do	do	do	(142)
		20 lb	do	Slight	do	(142)
		40 lb	do	do	Treated in June, N.Y	(142)

See footnotes at end of table, p. 78.

TABLE 10.—*Effects of certain aquatic herbicides on emergent weeds*—Continued

Trapa natans (Waterchestnut)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
	P.p.m.					
TCA		5 lb	Water	None	Treated in July, checked in Sept., N.Y.	(*142*)
Dalapon		6 lb	do	do	do	(*142*)
Monuron		10 lb	Granules (8–15 mesh).	do	Treated in June, N.Y	(*142*)
		20 lb	do	do	do	(*142*)
		40 lb	do	do	do	(*142*)
Monuron+TCA		10 lb	Granules (8–15 mesh).	Excellent (?)	Plots contaminated by other chemicals.	(*142*)
		20 lb	do	do	do	(*142*)
		40 lb	do	do	do	(*142*)
Amitrole		2 lb	Water	None	Treated in July, checked in in Sept., N.Y.	(*142*)
Polybor-chlorate		50 lb	Granules	do	Treated in June, N.Y.	(*142*)
		100 lb	do	do	do	(*142*)
		150 lb	do	do	do	(*142*)
Sodium arsenite (2)+sodium chlorate (1).		225 lb	Water	Effective	Not used because of danger	(*174*)
Sodium arsenite (1)+sodium chlorate (1).		300 lb			Ponds; recommended rate	(*232*)
TBA		3 lb	Granules	None	Treated in May, N.Y	(*142*)
		6 lb	do	do	do	(*142*)
		12 lb	do	do	do	(*142*)

[1] Except as indicated.
[2] AUBURN UNIVERSITY. DATA ON CHEMICAL WEED CONTROL IN PONDS. Ala. Agr. Expt. Sta., Farm Ponds Proj., Unpublished Ann. Rpts. 1946–61.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*

Acorus calamus (Sweetflag)

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
2,4-D, BE	0.5 percent	8 lb	Water	Good	Pond tests	(*149*)

Alnus rugosa and *A. serrulata* (Alders)

2,4-D	20 percent		Diesel fuel	100 percent	*Alnus rugosa*	(*174*)
2,4-D, TEA		1 lb	Water	do	*Alnus serrulata*	(*174*)
2,4,5-T	5 percent		Diesel fuel	90–100 percent	*Alnus rugosa*	(*174*)
	8 percent		do	100 percent	do	(*174*)

Alternanthera philoxeroides (Alligatorweed)

2,4-D, invert		4 lb		None	Treated July 9, checked in Oct., refuge plots.	(*242*)
		8 lb		do	do	(*242*)
		12 lb		do	do	(*242*)
2,4-D		9.8 lb	Granules	None	Treated July 18, checked Oct. 1, refuge plots.	(*242*)
		19.8 lb	do	do	do	(*242*)
		39.9 lb	do	do	Treated July 21, checked Oct. 1, refuge plots.	(*242*)
		217.8 lb	do	99 percent; some viable stems.	do	(*242*)
		435.6 lb	do	do	do	(*242*)
		8 lb		Eradicated	Second spraying to complete	(*156*)
		6.68 lb	PCE, 6 gal	None	Treated June 12, airplane, moist soil; checked in Sept.	(*100*)
		6.68 lb	H–J, 6 gal	do	do	(*100*)
		6.68 lb	H–T, 6 gal	do	do	(*100*)
		3 to 9 lb	Water	Ineffective	Treated May 18, rooted mats on moist soil.	(*240*)
		4 lb	Granules 30/60	Poor	Plants in water, treated July 22, checked Oct. 8.	(*240*)
		8 lb	do	Fair	do	(*240*)
		12 lb	do	75 percent	do	(*240*)
		16 lb	do	do	do	(*240*)
		4 lb	Granules 15/30	Poor	do	(*240*)
		8 lb	do	Fair	do	(*240*)
		12 lb	do	75 percent	do	(*240*)
		16 lb	do	do	do	(*240*)
2,4-D+wetting agent		8 lb.+3 percent	Water+Tween 20	Good	Plant in water, full bloom	(*240*)
		8 lb.+1 percent	Water+Tergitol #4.	do	do	(*240*)
		8 lb.+.1 percent	Water+Triton X 100.	do	do	(*240*)
		8 lb.+.5 percent	Water+Triton B–1956.	do	do	(*240*)
		8 lb.+.5 percent	Water+Triton X 188.	do	do	(*240*)
2,4-D		8 lb	Water	Good	Plant in water, full bloom	(*240*)
	7.5 percent	4 lb	Granules 30/60	50 percent	Plants in water, treated in Aug., checked in Oct.	(*240*)
		8 lb	do	60 percent	do	(*240*)
		12 lb	do	75 percent	do	(*240*)
	7.5 percent	4 lb	Granules 15/30	60 percent	do	(*240*)
		8 lb	do	80 percent	do	(*240*)
		12 lb	do	90 percent	do	(*240*)
		100 lb	Granules	Retarded	20-percent granular form	(*197*)
		1 to 1.5 lb	Water	Good	Sugarcane fields	(*115*)
		6 lb	Dust	Unsatisfactory	do	(*116*)
		10 lb	do	do	do	(*116*)
		14 lb	do	do	do	(*116*)
		16 lb	do	do	do	(*116*)
	1 percent				Ponds; recommended rate	(*232*)
	5 percent		Water	Killed plants	Used tributyl phosphate	(*122*)
		10 lb	do	Confined growth	3 to 6 sprayings per summer for 4 years.	(*174*)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Alternanthera philoxeroides (Alligatorweed)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
2,4-D, amine		8 lb	Water, 80 gal	Practically eradicated		(*174*)
2,4-D, ester		4.2 lb	Kerosene	2 percent	Treated July 15, 1957, Fla	(*121*)
2,4-D ester+aquaherb		14.2 lb	Water+spreader sticker.	1–2 percent	Treated Aug. 12, 1957, Fla	(*121*)
2,4-D, alkanolamine		2 lb		100 percent above water; 0 percent below water.	Pretreatment (floating plants)	(*211*)
2,4-D, acid		20, 40 lb	Granules	25, 65 percent	Rooted plots, S.C	(*211*)
2,4-D, PGBEE		20 lb	Granules	80–100 percent above water; 20–100 percent below water.	Depends on water movement (floating plants).	(*211*)
		8 lb	Oil	100 percent above water; 10 percent below water. Complete regrowth in 2 months.	Floating plants	(*211*)
		20, 40 lb	Granules	70 and 80 percent	Rooted plots, S.C	(*211*)
2,4-D, BEE, invert		10 lb	Kerosene+water	90 percent	Treated June 16, 1958, Fla	(*121*)
		do	do	85 percent	Treated Aug. 25, 1958, Fla	(*121*)
		do	do	90 percent	do	(*121*)
2,4-D, EE	0.1 percent	4 lb	Water	Good	Sugarcane fields	(*116*)
	0.2 percent	8 lb	do	Very good	do	(*116*)
	0.2 percent	4 to 6 lb	do		Plants in water, 2 to 3 sprayings per year. Recommended rate.	(*116*)
2,4-D, BE	0.1 percent	4 lb	Water	Good	Sugarcane fields	(*116*)
	0.2 percent	8 lb	do	Very good	do	(*116*)
	0.2 percent	4 to 6 lb	do		Plants in water, 2 to 3 sprayings per year. Recommended rate.	(*116*)
2,4-D, IOE		10, 20, 40 lb	Granules	None	Floating plants, La	(*211*)
2,4-D, IPE		3.34 lb	Water, 100 gal	50 percent	Treated June 6, sprayed, moist ditchbank, Ga.	(*226*)
		3.34 lb	do	25 percent	Treated June 1 and Sept. 3, sprayed, surface water, Ga.	(*226*)
2,4-D+2,4,5-T		19.8 lb	Granules	None	Treated June 21, checked Oct. 1, refuge plots.	(*242*)
		39.9 lb	do	do	do	(*242*)
		200 lb	do	100 percent; some viable stems.	Treated July 21, checked Oct. 1, refuge plots.	(*242*)
		5 lb	Water+spreader sticker.	1–2 percent	Treated July 15, 1957, Fla	(*121*)
2,4-D+2,4,5-T(2)+TCA(1)		19.2 lb	Water+spreader sticker.	1–2 percent	Treated Aug. 12, 1957, Fla	(*121*)
2,4-D, TBP	1.25 percent		Kerosene	Killed tops; few nodes produced regrowth.		(*122*)
	0.62 percent		do	Killed tops; several nodes produced regrowth.		(*122*)
	5 percent	6 lb	Water	Killed plants	Plot tests	(*122*)

2,4,5-T		19.8 lb	Granules	None	Treated July 21, checked Oct. 1, refuge plots.	(242)
		39.9 lb	do	5 percent	do	(242)
		200 lb	do	100 percent; some viable stems.	do	(242)
		5 lb	Water+spreader sticker.	1–2 percent	Treated July 15, 1957, Fla	(121)
		20 lb	Granules	95 percent	Treated May 29, 1958, Fla	(121)
2,4,5-T, IPE+CL_3POA	17.5 percent	8 lb		Complete for 3 months		(155)
Silvex, invert		4 lb		None	Treated July 9, checked in Oct., refuge plots.	(242)
		8 lb		do	do	(242)
		12 lb		do	do	(242)
Silvex, salt		10, 20, 40 lb	Granules	None	Floating plants, La	(211)
		20, 40 lb	do	85, 95 percent	Rooted plants, S.C	(211)
Silvex		3 to 9 lb	Water	Ineffective	Treated May 18, rooted mats on moist soil.	(241)
		2 lb	do	95 percent	Treated May 2 and Aug. 11, floating mats.	(241)
		4 lb	do	do	do	(241)
		8 lb	do	97 percent	do	(241)
		12 lb	do	99 percent	do	(241)
		16 lb	do	do	do	(241)
		2 lb	do	40 percent	Treated June 7, floating mats	(241)
		4 lb	do	50 percent	do	(241)
		8 lb	do	60 percent	do	(241)
		12 lb	do	80 percent	do	(241)
		16 lb	do	30 percent	do	(241)
		2 lb	do	50 percent	Treated May 6, dry at treatment, later flooded.	(241)
		4 lb	do	20 percent	do	(241)
		8 lb	do	50 percent	do	(241)
		12 lb	do	60 percent	do	(241)
		16 lb	do	90 percent	do	(241)
		4 lb	Water, 218 gal	100-percent top kill	Treated in May and Sept	(240)
		12 to 16 lb	do	100 percent	Treated in May and Sept., checked in Oct.	(240)
Silvex, PGBEE		20 lb	Granules	80–100 percent above water; 20–100 percent below water.	Depends on water movement, floating plants.	(211)
		8 lb	Oil	100 percent above water, 80 percent below water; regrowth retarded 3 months.	Floating plants	(211)
		10 lb		95 percent	Foliage spray, rooted plants, S.C.	(211)
		20, 40 lb	Granules	90, 95 percent	Rooted plants, S.C	(211)
Silvex, BEE		40 lb	Granules	90–100 percent	Ratings 6–14 months after treatment, S.C.	(211)
		30 lb	do	80–100 percent	do	(211)
		20 lb	do	do	do	(211)
Silvex, BEE+xylene+polychlorobenzene.		8 lb	Oil	100 percent above water; 80 percent below water.	Applied 2 weeks after 2,4-D pretreatment, floating plants.	(211)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Alternanthera philoxeroides (Alligatorweed)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Dalapon	----------	20 lb	----------	70 percent; 100-percent regrowth in 3 months.	Marsh test, La	(*240*)
	----------	40 lb	----------	90 percent; 5-percent regrowth in 3 months.	do	(*240*)
	----------	60 lb	----------	95 percent; 5-percent regrowth in 3 months.	do	(*240*)
	----------	80 lb	----------	100 percent; 2-percent regrowth in 3 months.	do	(*240*)
	----------	100 lb	----------	do	do	(*240*)
	----------	20 to 60 lb	Water	90- to 95-percent kill	Treated May 13, partly covered with water.	(*240*)
	----------	5, 10 lb	do	None	Treated Aug. 5, plots on well-drained soils.	(*241*)
	----------	20 lb	do	20 percent	do	(*241*)
	----------	30 lb	do	do	Treated Apr. 20 and Aug. 11, floating mats.	(*241*)
	----------	40 lb	do	50 percent	do	(*241*)
	----------	50 lb	do	80 percent	do	(*241*)
	----------	60 lb	do	do	do	(*241*)
	----------	20 lb	do	30 percent	Treated Apr. 26	(*241*)
	----------	30 lb	do	10 percent	do	(*241*)
	----------	40 lb	do	20 percent	do	(*241*)
	----------	50 lb	do	70 percent	do	(*241*)
	----------	60 lb	do	do	do	(*241*)
	----------	20 lb	do	do	Treated June 7	(*241*)
	----------	30 lb	do	60 percent	do	(*241*)
	----------	40 lb	do	70 percent	do	(*241*)
	----------	50 lb	do	60 percent	do	(*241*)
	----------	60 lb	do	40 percent	do	(*241*)
	----------	20 lb	do	25 percent	Treated Apr. 20 and Aug. 11	(*240*)
	----------	60 lb	Water, 218 gal	95 percent	Floating mats	(*240*)
	----------	80 to 100 lb	do	90 percent	Rooted plants, 5½ months	(*240*)
Dalapon + wetting agent	----------	48 to 96 lb	Water + Tween 20	No lasting effects	Plants not in water, includes single and multiple spraying.	(*240*)
MH + silvex	----------	2.5 lb. + 2 to 16 lb	Water, 218 gal	75–90 percent	July application, silvex 6 days after MH.	(*240*)
	----------	5 lb. + 2 to 16 lb	do	do	do	(*240*)
	----------	20 lb. + 2 to 16 lb	do	do	do	(*240*)
Amitrole + wetting agent	----------	Up to 40 lb	Water + Tween 20	No lasting effects	Plants not in water, Ga	(*240*)
Amitrole	----------	5 to 30 lb	Water	Ineffective	Treated May 24, flooded most of season.	(*101*)

Amitrole+emid		5 lb.+10 lb		80–100 percent	Ratings 6–14 months after treatment, S.C.	(211)
		5 lb.+15 lb		do	do	(211)
Amitrole+MCPA		5 lb.+10 lb		80–100 percent	Ratings 6–14 months after treatment, S.C.	(211)
		5 lb.+15 lb		do	do	(211)
Amitrole+silvex		5 lb.+10 lb		80–90 percent	Ratings 2–14 motths after treatment, S.C.	(211)
Amitrole+fenac		1 lb.+3 lb		None	Floating plants, La	(211)
		1 lb.+9 lb		do	do	(211)
		1 lb.+18 lb		do	do	(211)
		2 lb.+3 lb		do	do	(211)
		2 lb.+9 lb		do	do	(211)
		2 lb.+18 lb		do	do	(211)
		4 lb.+3 lb		do	do	(211)
		4 lb.+9 lb		do	do	(211)
		4 lb.+18 lb		do	do	(211)
Erbon		70 to 160 lb	Water	100 percent	Treated May 16, area remained unflooded.	(225)
		80 lb		20 percent	Treated June 12, sprayed, moist soil, checked Oct. 1.	(100)
		97 lb		30 percent	do	(100)
		114 lb		60 percent	do	(100)
		131 lb		do	do	(100)
		148 lb		80 percent	do	(100)
		165 lb		do	do	(100)
		182 lb		do	do	(100)
		200 lb		do	do	(100)
		80 lb. (each)		90 percent	Treated May 15, and Aug. 9, ditchbank.	(101)
		85 lb		20 percent	Treated May 15, ditchbank	(101)
		90 lb		do	do	(101)
		100 lb		10 percent	do	(101)
		110 lb		25 percent	do	(101)
		120 lb		do	do	(101)
		130 lb		20 percent	do	(101)
		140 lb		25 percent	do	(101)
		150 lb		do	do	(101)
		160 lb		do	do	(101)
Erbon+dalapon		40 lb.+40 lb	Water	15 percent	Treated June 11, sprayed, moist soil, checked Oct.1.	(100)
		40 lb.+20 lb	do	8 percent	do	(100)
		20 lb.+20 lb	do	5 percent	do	(100)
		0 lb.+40 lb	do	do	do	(100)
		80 lb.+0 lb		15 percent	do	(100)
		80 lb.+40 lb		do	do	(100)
		80 lb.+20 lb		20 percent	do	(100)
		60 lb.+40 lb		15 percent	do	(100)
AMS X		76 lb	Water+spreader sticker.	1 percent	Treated July 15, 1957, Fla	(121)
Simazine		10 lb	Granules	None	Treated Apr. 23, 1958, Fla	(121)
Borascu		5,500 lb		Eradicated	Dewatered area	(174)
Chlorea		393 lb	Granules	30 percent	Treated Apr. 23, 1958, Fla	(121)
Sodium chlorate		4,300 lb		None		(174)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Allernanthera philoxeroides (Alligatorweed)—Continued						
Fenac		1.5 lb	Water	10 percent	Treated May 6, plots partially dry, plants rooted.	(*241*)
		3 lb	do	do	do	(*241*)
		6 lb	do	40 percent	do	(*241*)
		9 lb	do	50 percent	do	(*241*)
		12 lb	do	60 percent	do	(*241*)
		1.5 lb. (each)	do	10 percent	Treated May 2 and July 29, floating mats.	(*241*)
		3 lb. (each)	do	40 percent	do	(*241*)
		6 lb. (each)	do	50 percent	do	(*241*)
		9 lb. (each)	do	60 percent	do	(*241*)
		12 lb. (each)	do	90 percent	do	(*241*)
		1.5 lb	do	10 percent	Treated June 7, floating mats	(*241*)
		3 lb	do	None	do	(*241*)
		6 lb	do	do	do	(*241*)
		9 lb	do	10 percent	do	(*241*)
		12 lb	do	None	do	(*241*)
		0.5 lb	Water, 100 gal	do	Floating or rooted plants	(*211*)
		1 lb	do	do	do	(*211*)
		3 lb	do	do	do	(*211*)
		6 lb	do	do	do	(*211*)
		3 lb	do	do	do	(*211*)
		6 lb	do	do	do	(*211*)
		9 lb	do	do	do	(*211*)
		12 lb	do	do	do	(*211*)
		18 lb	do	do	do	(*211*)
2-chloro-4-fluorophenoxy-acetate (dimethylamine).		8 lb		100 percent above water; 80 percent below water. Regrowth retarded 4 months.	Floating plants, Fla	(*211*)
2-chloro-4-fluorophenoxy-acetate (n-butyl ester).		8 lb		100 percent above water; 20–30 percent below water.	do	(*211*)
Diquat		2 lb		100 percent above water; 0 percent below water. Rapid top kill.	do	(*211*)
Alanap-5		20 lb	Water	Poor	Marsh tests, sprayed plots	(*101*)
		45 lb	do	do	do	(*101*)
Polyborchlorate		5,000 lb		Eradicated	Dewatered area	(*174*)
Sodium chloride		15 tons		None		(*174*)
Monuron (CMU)		60 lb		Promising	Dewatered area	(*174*)
Carex aquatilis (Ripgutgrass)						
2,4-D, acid		16.4 lb		85 percent	Irrigation channel	(*180*)
2,4-D, amine		35.5 lb		90 percent	Greenhouse tests, ⅓ at 2d application, checked 6 weeks after 2d application.	(*181*)

2,4-D, IPE		43.4 lb		75 percent	do	(181)
		5.3 lb		10 percent	do	(181)
		4 lb		do	do	(181)
2,4-D, sodium		21.3 lb		65 percent	Greenhouse tests, ⅓ at 2d application, checked 6 weeks after 2d application.	(181)
2,4-D, TBP		16.4 lb	Kerosene	85 percent	do	(181)
2,4-D, micronized		12 lb		10 percent	do	(181)
2,4,5-T, IPE		44.7 lb		80 percent	do	(181)
MH		15.6 lb		None	do	(181)
Carex atherodes (Oregon sugargrass)						
2,4-D, acid		34 lb		95 percent	Irrigation channel	(180)
Cephalanthus occidentalis (Buttonbush)						
2,4-D	2 percent		Water		Recommended rate	(232)
2,4-D, TEA		3 lb	do	Resistant	Lake tests, TVA	(147)
2,4-D, BE		7.4 lb	do	do	do	(147)
2,4-D, ME		3 lb	do	do	do	(147)
2,4-D, IPE	0.4 percent			50–80 percent	From shallow to deep water	(174)
2,4-D + 2,4,5-T (1:1)		2 lb	Water, 25 gal	100 percent	Treated July 25, spray, Ky	(101)
2,4,5-T	2 percent		Water		Recommended rate	(232)
		5.5 lb		100 percent		(174)
AMS	8 percent		Water	Good		(174)
Cyperus acuminatus (Sedge)						
2,4-D, IPE	0.5 percent	6 to 8 lb	Diesel fuel	Good	Pond tests	(2)
Diuron	2.5 p.p.m			do	Pond tests, Oreg. (*Cyperus* sp.)	(109)
Amitrole + dalapon		5 lb. + 5 lb	Water	Poor kill	Pond tests	(210)
AMS		150 to 450 lb	Detergent	Killed tops; regrowth from roots.	do	(103)
		150 lb	Water + Vatsol OS.	do	do	(103)
Cyperus erythrorhizos (Sedge)						
2,4-D, IPE	0.5 p.p.m	6 to 8 lb	Diesel fuel	Good	Pond tests	(2)
TCA + silvex		21.6 lb. + 10.4 lb	Water	97 percent	do	(210)
Dalapon + erbon		5 lb. + 10.4 lb	do	Not effective	do	(210)
		5 lb. + 20.8 lb	do	90-percent kill	do	(210)
Amitrole + dalapon		5 lb. + 5 lb	Water	Poor kill	Pond tests	(210)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Cyperus giganteus (Egyptian paperplant)						
2,4-D		10 lb	Water, 218 gal	98 percent	Treated July 1, checked Oct. 11.	(*240*)
		2 lb	Water, 218 gal	40 percent	Applied in May, checked in Oct.	(*240*)
2,4-D, amine		4 lb	do	80 percent	do	(*240*)
		8 lb	do	90 percent	do	(*240*)
		10 lb	do	95 percent	do	(*240*)
		12 lb	do	98 percent	do	(*240*)
		16 lb	do	do	do	(*240*)
		2 to 8 lb	do	90 percent	Treated in June and Sept., checked in Oct.	(*240*)
		10 to 16 lb	do	100 percent	do	(*240*)
Silvex		2 lb	Water, 218 gal	40 percent	Treated July 1, checked Oct. 11.	(*240*)
		4 lb	do	60 percent	do	(*240*)
		8 lb	do	90 percent	do	(*240*)
		10 lb	do	95 percent	do	(*240*)
		12 lb	do	98 percent	do	(*240*)
		16 lb	do	do	do	(*240*)
Dalapon		20 to 40 lb	Water, 218 gal	90 percent	Plants in 6- to 12-inch brackish water.	(*240*)
		60 to 100 lb	do	97–99 percent	do	(*240*)
MH+2,4-D		20 lb. + 4 or 10 lb.	Water, 218 gal	98–100 percent	2,4-D applied 8 days after MH.	(*240*)
(*Decodon americana*) (Waterwillow)						
2,4-D, BE	0.1 percent	4 lb	Water + 2% Tide	Excellent	Pond tests	(*175*)
	0.3 percent		Water	Good	do	(*149*)
	0.1 percent		do	do		(*104*)
2,4-D, alkanolamine salt	0.25–1 percent.		Water	Eradicated	Pond tests	(*149*)
2,4,5-T	0.3 percent		Water + 2% Tide	Good	do	(*175*)
AMS		450 lb	Water + Vatsol OS.	Killed upper half	do	(*103*)
Decodon verticillatus (Waterwillow)						
Monuron		75 lb		95 percent	Pond tests, N.J	(*159*)
		100 lbs		do	do	(*159*)
		125 lb		do	do	(*159*)

Distichlis spp. (Saltgrasses)						
2,4-D, IPE		20 lb	Water	No effect	Marsh tests, tractor sprayer	(*178*)
Eleocharis obtusa (Spikerush)						
2,4-D, PGBEE		5.2 lb	Water	95 percent	Pond tests	(*210*)
		4.8 lb	Diesel fuel	90–100 percent	do	(*210*)
2,4-D, BE	0.5 percent		Diesel fuel	75–100 percent	Dry pond edge, 1 season	(2)
	0.5 percent		do	do	do	(2)
2,4-D, IPE		4 to 8 lb	Diesel fuel	90–100 percent	Pond tests	(*210*)
2,4-D, TBP	5 percent		Kerosene	Good kill		(*231*)
2,4-D+2,4,5-T		4 lb	Water, 80 gal	75 percent	Spray application, pond tests, Ga.	(*236*)
2,4,5-T, ester		4 lb	do	100 percent	do	(*236*)
Silvex		10.4 lb		88 percent	Pond tests	(*210*)
		20.4 lb		100 percent	do	(*210*)
TCA+silvex		10 lb.+20.8 lb	Water	98 percent	Pond tests	(*210*)
TCA+2,4-D,Na salt	0.25 percent+0.5 percent.	2 lb.+4 lb	do	None	do	(2)
	0.25 percent+0.5 percent.	4 lb.+8 lb	do	Good	do	(2)
	1 percent+1 percent.	8 lb.+8 lb	do	None	do	(2)
	1 percent+1 percent.	80 lb.+80 lb	do	Good	do	(2)
	0.5 percent+0.5 percent.	40 lb.+40 lb	do	do	do	(2)
TCA+2,4,5-T	0.5 percent+0.5 percent.	4 lb.+4 lb	Water	None	Pond tests	(2)
	0.5 percent+0.5 percent.	40 lb.+40 lb	do	Good	do	(2)
TCA		21.6 lb	Water	None	Pond tests	(2)
Dalapon		24 lb	Water, 80 gal	100 percent	Spray application, pond tests, Ga.	(*236*)
		10 lb	Water	Resistant	Pond tests	(*210*)
Diuron		75 lb	Water	Good	Dewatered pond edge, 1 year	(*210*)
	1.2 p.p.m	16 lb		do	Filled pond, 1 year	(2)
		60 lb	Water	do	Dry pond edge, 1 year	(2)
Amitrole		6.8 lb	Water	90–95 percent	Pond tests	(*210*)
Erbon		10.4 lb	Diesel fuel	90 percent	do	(*210*)
Eleocharis quadrangulata (Square-stem spikerush)						
2,4-D	0.5 percent				Ponds; recommended rate	(*232*)
Equisetum sp. (Horsetail)						
Monuron	5 p.p.m			Killed	Pond tests, Oreg	(*109*)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Glyceria sp. (Mannagrass)						
2,4-D, IOE		430 lb	Granules	None; 100-percent regrowth 2d year.	Pond tests, Ga., 1958	(*235*)
2,4-D, IPE		100 lb	do	None	Broadcast application, pond tests, Ga.	(*236*)
Silvex		8 lb	Water, 80 gal	do	Spray application, pond tests, Ga.	(*236*)
Silvex+dalapon		2.5 lb.+5 lb	Water	50 percent	Pond test, Ga., retreatment	(*235*)
Dalapon		20 lb	Water	75 percent	Pond test, Ga., retreatment	(*235*)
		16 lb	Water, 80 gal	100 percent	Spray application, pond tests, Ga.	(*236*)
Dalapon+erbon		15 lb.+6 lb	Water, 80 gal	50 percent	Spray application, pond tests, Ga.	(*236*)
Monuron	10 p.p.m			Killed	Pond tests, Oreg	(*109*)
Diuron	5 p.p.m			do	Pond tests, Oreg	(*109*)
	10 p.p.m			do	do	(*109*)
Erbon		6 lb	Water, 80 gal	50 percent	Spray application, pond tests Ga.	(*236*)
		32 lb	do	do	do	(*236*)
Chlorea		1,600 lb	Granules	None	Broadcast application, pond tests, Ga.	(*236*)
		1,720 lb	do	None; 100-percent regrowth 2d year.	Pond tests, Ga., 1958	(*235*)
Hibiscus militaris and *H. moscheutos* (Rosemallow)						
2,4,D	0.5 percent	6.5 lb		95 percent	160 gals. per acre	(*174*)
2,4,D, alkanolamine salt	0.25–1 percent.		Water	Eradicated	Pond tests	(*149*)
2,4-D (P)		10 lb		No kill	do	(*149*)
2,4-D, BE	0.3 percent	2 lb	Water	Good	do	(*149*)
Sodium arsenite	4 p.p.m			Effective kill	do	(*149*)
Hydrocotyle umbellata (Pennywort)						
2,4-D		1 to 1.5 lb	Water	Killed	Sugarcane fields	(*210*)
2,4-D, BE	0.5 percent	40 lb	Water	100 percent	Dewatered pond area	(2)
	0.1 percent	8 lb	do	95 percent	do	(2)
2,4-D, IPE	0.5 percent	4 to 8 lb	Diesel fuel	Fair to good	Pond tests, plants in water	(2)
2,4-D, Na salt	0.2 percent	16 lb	Water	80 percent	Dewatered pond area	(2)
	0.4 percent	32 lb	do	95 percent	do	(2)
	1 percent	80 lb	do	100 percent	do	(2)

Juncus spp. (Tussock or rushes)

Monuron	5 p.p.m			Killed	Pond tests, Oreg	(*109*)
	10 p.p.m			do	do	(*109*)
Diuron	2.5 p.p.m			Injured	Pond tests Oreg	(*109*)
	5 p.p.m			Killed	do	(*109*)
	10 p.p.m			do	do	(*109*)

Juncus effusus (Soft rush)

2,4-D (P)		80 to 100 lb	Granules	Partial	Pond tests, Ark., treated May 7, checked June 24.	([3])
2,4-D, salt		3 lb	Water	Good	Dewatered areas	(*211*)
2,4-D	1 percent				Ponds, recommended rate for spray.	(*232*)
2,4-D, PGBEE		4.8 lb	Diesel fuel	90–100 percent	Pond tests	(*210*)
2,4-D, IPE		4 to 8 lb	do	do	do	(*210*)
2,4-D+2,4,5-T		4 lb	Water, 80 gal	None	Spray application, pond test, Ga.	(*236*)
Silvex		16 lb	do	100 percent	do	(*236*)
Silvex, PGBEE		3 lb	Water	100 percent; no regrowth 2d year.	Ga	(*211*)
		12 lb	do	100 percent	Pond tests, Ga	(*211*)
TCA+silvex		10 lb.+20.8 lb	Water	98 percent	Pond tests	(*210*)
Dalapon		10 lb	Water	Resistant	do	(*210*)
		12.8 lb	do	100 percent	Pond tests, Ga	(*211*)
		24 lb	Water, 80 gal	do	Spray application, pond tests, Ga.	(*236*)
Diuron		65 lb	Water	Complete kill	Dewatered pond bottom, 21-month test.	(*210*)
Amitrole		13.6 lb	do	Failed to kill	Pond tests	(*210*)
Erbon		10.4 lb	Diesel fuel	90 percent	do	(*210*)
		16 lb	Water, 80 gal	None	Spray application, pond tests, Ga.	(*236*)
Chlorea		860 lb	Granules	75 percent	Broadcast application, pond test, Ga.	(*236*)
Copper sulfate	3 p.p.m			None	Lake tests, acid water	(*206*)

Justicia americana (Dianthera)

2,4-D, salt		3 lb	Water		Dewatered areas; recommended rate.	(*211*)
		8 lb	do	Very effective	Dewatered areas	(*211*)
2,4-D, Na salt		1 lb	Water	Intermediate susceptible.	Dewatered areas	(*147*)
	0.1 percent	3 lb	do	Good	do	(*147*)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Leersia sp. (Cutgrass)						
2,4,5-T, PGBEE		5 lb	Water (1:80)	None	Pond tests, Ga., 1959	(*235*)
Silvex+dalapon		1.5 lb.+1 lb	Water (1:40)	75 percent	do	(*235*)
Dalapon		40 lb	Water, 100 gal	100 percent; no regrowth 2d year.	Pond tests, Ga., 1958	(*235*)
		10 lb	do	100 percent; 10-percent regrowth 2d year.	do	(*235*)
		10 to 20 lb	do	100 percent; 5-percent regrowth 2d year.	do	(*235*)
		9 lb	Water (1:10)	100 percent	Pond tests, Ga., 1959	(*235*)
		12 lb	Water (1:8)	do	do	(*235*)
Dalapon+2,4-D+2,4,5-T		10 lb.+2 lb	Water	100 percent; 5-percent regrowth 2d year.	Pond tests, Ga., 1958	(*235*)
Simazine		210 lb	Granules	10 percent	Pond tests, Ga	(*235*)
Leersia oryzoides (Cutgrass)						
2,4-D, PGBEE		4.8 lb	Diesel fuel	90–100 percent	Pond tests	(*210*)
2,4-D, IPE		4 to 8 lb	do	do	do	(*210*)
Silvex		10.4 lb	Diesel fuel	88 percent	Pond tests	(*210*)
		83.2 lb	do	80 percent	do	(*210*)
TCA		43.2 lb	Water	99 percent	Pond tests	(*210*)
Dalapon		10 lb	do	Partial	do	(*210*)
Amitrole		10 lb	do		Ponds; recommended rate	(*210*)
Amitrole+TCA		3.4 lb.+21.6 lb	do	98 percent	Pond tests	(*210*)
Amitrole+erbon		3.4 lb.+20.8 lb	do	96 percent	do	(*210*)
Amitrole+dalapon		5+5 lb	do	97 percent	do	(*210*)
Erbon		10.4 lb	Diesel fuel	90 percent	do	(*210*)
Myrica cerifera (*Cerothamnus ceriferus*) (Waxmyrtle)						
2,4-D		8.4 lb	Diesel oil, 11 gal	75 percent	Treated July 18, airplane, 1 year.	(*241*)
2,4-D+2,4,5-T		4.2 lb.+4.2 lb	do	70 percent	do	(*241*)
2,4,5-T		8.4 lb	do	60 percent	do	(*241*)
Silvex		8 lb	Diesel fuel	20 percent	Treated July 18, airplane, 1 year	(*241*)
		4 lb	do	10 percent	do	(*241*)
2,3,6 TBA		9 lb	Diesel oil, 11 gal	50 percent	Treated July 18, airplane, 1 year.	(*241*)
		15 lb	do	75 percent	do	(*241*)

Nelumbo lutea (*N. pentapetala*) (Lotus)

2,4-D, amine		4 lb	Water (1:100)	95 percent	Treated July 25, Ky	(*225*)
2,4-D		.75 lb	Diesel oil	70 percent	Treated July 26, Ill	(*225*)
		2.4 lb		100 percent	Treated June 27, airplane, La.	(*225*)
		5 lb	Water	100-percent kill	Treated Aug. 19, sprayed, Ill.	(*226*)
		4 lb. (each)	Water + detergent.	99 percent	Treated June 18 and July 19, sprayed, Miss.	(*226*)
		2 lb		Good	Aerial application	(*174*)
		1.8 to 4 lb		do	Boat application	(*174*)
	0.5 p.p.m		Oil		Ponds; recommended rate	(*232*)
	0.5–0.6 percent.		Water + detergent.		Recommended rate	(*215*)
2,4-D, amine salt		3.1 lb	Water, 5 gal	50–90 percent	Air treatment, July, 160 acres, refuge.	(*98*)
2,4-D, ester		2 lb. (each)	Water, 100 gal. + liquid soap.	100 percent	Treated July 6 and Aug. 3, sprayed, Miss.	(*226*)
		2.23 lb		do	Aerial application, undiluted	(*97*)
		1 lb	Oil	Good	Applied during growing season.	(*211*)
	0.5 percent			95–100 percent	80 gal. solution per acre	(*174*)
2,4-D, salt	0.5 percent			95–100 percent	80 gal. solution per acre	(*174*)
2,4-D, alkanolamine		2 to 3 lb	Water	90–99 percent	Air application, before bloom, La. and S.C.	(*211*)
2,4-D, ME	5 percent	1 lb	Water	Satisfactory	Lake tests, TVA	(*147*)
	5 percent	3 lb	do	do	do	(*147*)
2,4-D, BE	1 percent		Water	Good	Pond tests	(*149*)
	4 percent	.8 lb	do	do	Lake tests, TVA	(*147*)
	4 percent	2.4 lb	Kerosene	do	do	(*147*)
	0.1–0.2 percent.		Water	do	Pond tests	(*104*)
2,4-D, IPE		2 to 3 lb	Oil	90–99 percent	Air application, before bloom, La. and S.C.	(*211*)
		2.23 lb		100 percent	Treated June 29, airplane, La.	(*225*)
		2.23 lb		do	Treated June 15, sprayed, La.	(*225*)
		3.34 lb	Water	do	Tractor sprayer, Ga	(*101*)
2,4-D, Na salt	0.5 percent	3 lb	Water	Good	Lake tests, TVA	(*147*)
2,4-D, TEA		2 lb	Water	95–100 percent	Lake tests, TVA	(*147*)
		3 lb	do	100 percent	35-acre block, TVA	(*147*)
2,4-D + surfactant		4 lb	Water	100 percent	Late summer, full bloom	(*211*)
2,4-D, Dowanol		20 lb	Granules	80 percent	Lake water, pH 9.1–9.3	(*211*)
2,4-5-T	0.5–0.6 percent.			Very effective		(*174*)
Dalapon		5 to 20 lb	Water	Erect leaves killed	Treated June 23, plants in water.	(*223*)
		20 lb	Water, 11 gal	Unsatisfactory	Airplane, research trials	(*99*)
AMS		95 lb		Very effective		(*174*)
		100 to 300 lb	Water	Killed tops; regrowth from roots.	Pond tests	(*103*)
		300 lb	Vatsol OS	Killed	do	(*149*)
Waste oil + kerosene		30 lb. + 15 lb		Injured tops	Pond tests	(*174*)
Silvex, PGBEE		3 lb	Water	100 percent	June application	(*211*)
Silvex, acid, Na salt, PGBEE		20 lb	Granules	80 percent	Lake water, pH 9.1–9.3	(*211*)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Orontium aquaticum (Goldenclub)						
MH		20 lb		100-percent top kill; regrowth in 1 month.		(*224*)
Benoclor 3C		20 gal		100-percent top kill; regrowth in 3.5 months.		(*224*)
Panicum hemitomon (Maidencane)						
2,4-D+TCA		64 lb.+30 lb	Water	75 percent	Treated June 20, 1958, Fla	(*121*)
TCA		240 lb	Water	Eradicated	Treated in May	(*240*)
		Over 285 lb	do	do	Treated in July	(*240*)
		60 lb	do	99 percent; regrowth after disking.	Sprayed	(*240*)
		435 lb	do	Minimum effective	Experiments on Santee Refuge.	(*224*)
Dalapon		10, 15, 20 lb	Water	90 percent	Air application, water 15 inches, S.C.	(*211*)
		20 lb	do	do	Air application following burning, water 2–3 inches.	(*211*)
		20 lb		Poor	Air application, 10-acre plot, water 2–3 inches, S.C.	(*211*)
		20 lb	Water	95 percent	Winter-burned plots, treated in Apr., Fla. and S.C.	(*99*)
		10 lb	Water, 8 gal	99 percent	Air treated May 2, 3-acre plot, refuge.	(*242*)
		10 lb.+5 lb	Water, 8 gal. (each).	do	Air treated May 2 and 28, 3-acre plot, refuge.	(*242*)
		20 lb	Water, 8 gal	90–95 percent	Air treated in 1957, checked Oct. 1958, refuge.	(*242*)
		5 lb	Water	90 percent	Treated May 9, plants on ditchbank.	(*101*)
		5 lb. (each)	do	95 percent	Treated May 9 and June 4	(*101*)
		20 lb	do	100 percent	do	(*101*)
		20 lb	Water, 11 gal	90-percent kill	Treated Apr. 24, old ricefield, surface moist.	(*101*)
		20 lb	do	90 percent	Dewatered area	(*99*)
		20 lb	Water, 8 gal	Poor to 95 percent	Less than 15 inches of water	(*99*)
		10 lb	Water	Fair	Treated in Mar	(*223*)
		20 to 60 lb	do	100 percent	do	(*223*)
		20 to 100 lb	do	Complete kill	Treated Apr. 20, dry at treatment, later flooded.	(*223*)
		20 to 80 lb	do	Poor to good	Treated May 25, flooded at treatment.	(*223*)

Dalapon—Continued		100 lb	do	Complete kill	do	(223)
		10 to 40 lb	do	Fair to good	Treated Mar. 2, plots dry	(223)
		10 lb	do	do	do	(223)
		20 to 60 lb	do	Complete kill	do	(223)
		75 to 100 lb	do	Eradicated	Treated in May	(223)
		150 to 192 lb	do	do	Treated in July	(240)
		30 lb	do	99 percent; regrowth after disking.	Sprayed	(240)
		60 lb	do	90 percent	Treated Aug. 20	(240)
		4 to 5 lb. (each)	do		Ponds in Israel, 2 or 3 applications; recommended rate.	(201)
Dalapon+TCA		150 lb.+50 lb	Water	Best kill	Single application	(240)
Monuron		10 lb	Water	Erratic	Treated Apr. 20, drained area	(223)
		30 lb	do	do	Flooded later	(223)
		50 lb	do	do	do	(223)
		80 lb	do	do	do	(223)
Amitrole		10 lb	Water	Killed tops	Refuge tests	(223)
		20 lb	do	do	do	(223)
		5 lb	do	10 percent	Treated Mar. 30, earlier application ineffective.	(223)
		10 lb	do	Fair	do	(223)
		20 lb	do	95 percent	do	(223)
		5 lb	do	10 percent	Treated in Mar	(223)
		10 lb	do	5 percent	Treated June 7, flooded plots, control to Oct. 2.	(101)
		20 lb	do	15 percent	do	(101)
		30 lb	do	25 percent	do	(101)
		40 lb	do	70 percent	do	(101)
		50 lb	do	95 percent	do	(101)
		20 lb	do	do	Research trials	(241)
		10 lb	Water, 150 gal	5–7 percent	Treated June 25, 1958, Fla	(121)
Chlorox		100 to 400 lb	Water	None	Research trials	(241)
Chlorox '40'		100 lb	Water	Ineffective	Treated Mar. 30	(241)
		200 lb	do	do	do	(241)
		200 lb	Dry powder	do	do	(241)
		400 lb	do	do	do	(241)
Borascu		1 to 3 tons		Killed	On dewatered areas	(174)
Dowpon		17 lb	Water, 170 gal	3–5 percent	Treated June 25, 1958, Fla	(121)
HCA		80 lb	Kerosene, 100 gal	85 percent	Treated Dec. 1, 1958, Fla	(121)
2,3,6 TBA		1.5 to 30 lb	Water	None	Research trials	(241)
		1.5 to 30 lb	do	None to poor	1 treatment, one series in Apr., other series in May.	(241)
Goodrich 5TCO 6		50 to 100 lb	Water	90 percent	Treated in Feb	(240)
		25 lb	do	50-percent kill; 90-percent regrowth in 7 months.	do	(240)
		100 lb	do	90 percent	Treated in Apr	(240)
Monuron (CMU)		60 to 80 lb		Effective	On dewatered areas	(174)
Polybor-chlorate		1 to 3 tons		Killed	do	(174)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Panicum purpurascens (*P. barbinode*) (Paragrass)

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
TCA		150 lb	Water, 150 gal	Fair	Canal bank, Fla	(*213*)
		100 lb	Water, 100 gal	do	do	(*213*)
		125 lb	Water, 250 gal	do	do	(*213*)
		150 lb	Water, 150 gal	Some kill	Applied after aromatic oils	(*196*)
		60 lb	Water, 60 gal	do	do	(*196*)
		25 lb	Water, 125 gal	Good	Application every 3–6 weeks, 1 year, canal bank, Fla.	(*213*)
TCA + wetting agent		125 lb	Water, 125 gal. + Dreft, 19 oz.	Fair	Canal bank, Fla	(*213*)
		125 lb	Water, 125 gal. + kerosene, 2.5 gal., + Triton, ¾ pt.	Poor	do	(*213*)
		125 lb	Water, 125 gal. + Xylol, 2.5 gal. + Triton, ¾ pt.	Fair	do	(*213*)
Calcium TCA		125 lb	Water, 125 gal	Poor	Canal bank, Fla	(*213*)
TCA + Shell weedkiller 130		60 lb. +15 gal	Water, 120 gal	do	do	(*213*)
		15 gal. +60 lb	Water, 110 gal. + and 60 gal.	Good	TCA 3 weeks after Shell weedkiller, 1 year, canal bank, Fla.	(*213*)
TCA, IPE		11¼ gal	Water, 125 gal Triton emulsifier, 1 pt.	Poor	Canal bank, Fla	(*213*)
Dalapon		15 lb	Water	Good	With surfactant	(*211*)
		32 lb	do	Effective	Irrigation channels, Fla	(*130*)
		10 lb	Water, 100 gal	Good	Repeated applications	(*212*)
Diuron		80 lb	Water, 160 gal	Effective kill	Irrigation channels, 1 year	(*213*)
Amitrole		12 to 18 lb	Water	Efficient	Irrigation ditches	(*220*)
Polybor-chlorate		825 lb	Water, 625 gal	Poor kill	Irrigation channels	(*213*)
		412 lb	Water, 315 gal	Excellent	Following aromatic oils	(*213*)
Polybor-chlorate 88		825 lb	Water, 625 gal	Poor	Canal bank, Fla	(*213*)
Shell weedkiller 130 + Polybor-chlorate 88.		15 gal. and 412 lb.	Water, 100 gal. and 315 gal.	Good	Polybor-chlorate 6 weeks after weedkiller, 1 year, canal bank, Fla.	(*213*)

Panicum repens (Panicum)

Dalapon		7.5 lb		40 percent	Treated May 15, dry sites on ditchbank.	(*101*)
		10 lb		do	do	(*101*)
		12.5 lb		50 percent	do	(*101*)
		15 lb		75 percent	do	(*101*)
		17.5 lb		do	do	(*101*)
		20 lb		do	do	(*101*)
		22.5 lb		do	do	(*101*)
		25 lb		do	do	(*101*)
		30 lb		do	do	(*101*)

	----------	5 lb	Water	60 percent	Treated May 15, wet site within the pool.	(101)
	----------	7.5 lb	do	do	do	(101)
	----------	10 lb	do	do	do	(101)
	----------	12.5 lb	do	75 percent	do	(101)
	----------	15 lb	do	85 percent	do	(101)
	----------	17.5 lb	do	do	do	(101)
	----------	20 lb	do	90 percent	do	(101)
	----------	22.5 lb	do	95 percent	do	(101)
	----------	25 lb	do	85 percent	do	(101)
	----------	30 lb	do	95 percent	do	(101)
	----------	5 lb.+5 lb	do	85 percent	Treated May 15 and July 24, both wet and dry sites.	(101)
	----------	5 lb.+10 lb	do	do	do	(101)
	----------	5 lb		50–60 percent	Treated May 18, plots partially dry.	(241)
Dalapon—Continued	----------	10 lb		60–70 percent	do	(241)
	----------	20 lb		70–80 percent	do	(241)
	----------	30 lb		90–95 percent	do	(241)
	----------	5 lb		40 percent	Treated May 15, dry sites on ditchbank.	(101)
		20 lb	Water	85-percent top kill; 100-percent survival of rhizomes.	Fla	(241)
	----------	40 lb	do	90 percent; 100-percent survival of rhizomes.	do	(241)
	----------	60 lb	do	99 percent; 80-percent survival of rhizomes.	Fla	(241)
	----------	80 lb	do	100 percent; 50-percent survival of rhizomes.	do	(241)
	----------	10 to 30 lbs	Water	Ineffective	Treated May 15, surface water, highly organic soil.	(101)
	----------	20 lb	do	None	Treated May 20, plots dry thereafter.	(241)
	----------	30 lb	do	10–20 percent	do	(241)
	----------	40 lb	do	40–50 percent	do	(241)
	----------	50 lb	do	70–80 percent	do	(241)
	----------	60 lb	do	80–85 percent	do	(241)
Monuron	----------	70 lb	do	90–95 percent	do	(241)
	----------	80 lb	do	do	do	(241)
	----------	20 lb	do	100 percent	Treated May 13, plots flooded after treatment.	(241)
	----------	30 lb	do	do	do	(241)
	----------	40 lb	do	do	do	(241)
	----------	50 lb	do	do	do	(241)
	----------	60 lb	do	do	do	(241)
	----------	70 lb	do	do	do	(241)
	----------	80 lb	do	do	do	(241)
2,3,6 TBA	----------	3 to 30 lb	Water	Ineffective	Treated in May, plots not covered with water.	(241)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Paspalum distichum (Knotgrass)						
2,4-D, BE	0.25 percent		Diesel fuel	Good	Pond tests, plants in water	(2)
	0.5 percent	16 lb	do	Excellent top kill	do	(2)
	0.5 percent	16 lb	Water	50-percent top kill	do	(2)
2,4-D, BE + 2,4,5-T	0.25 percent +0.25 percent.	8 lb.+ 8 lb	Diesel fuel	Excellent top kill	Pond tests, plants in water	(2)
2,4-D, IPE	0.25 percent	4 to 6 lb	do	Fair to good	do	(2)
	0.5 percent	6 to 8 lb	Water + Tide	Poor kill	do	(2)
	0.5 percent	6 to 8 lb	Diesel fuel	Good	do	(2)
2,4,5-T	0.5 percent	6 to 8 lb	Diesel fuel	Excellent	Pond tests, plants in water	(2)
	0.5 percent	6 to 8 lb	Water	50 percent	do	(2)
2,4,5,-T, ester		4 lb	Water, 80 gal	None	Sprayed on plants in shallow water in ponds, Ga.	(*236*)
TCA	0.5 percent	16 lb		Partial top kill	Pond tests, plants in water	(2)
Dalapon		10 lb	Water	Susceptible	Pond tests	(*210*)
	1 percent		do	No kill	Pond tests, plants in water	(2)
		24 lb	Water, 80 gal	100 percent	Sprayed onto exposed plants, in ponds, Ga.	(*236*)
		50 lb.+3 lb	Water + Tide	do	do	(*236*)
		8 lb	Water	do	Sprayed on plants in shallow water, in ponds, Ga.	(*236*)
Diuron	1.2 p.p.m	16 lb		Good	Filled pond, 1 year	(2)
	2.5 p.p.m			Killed	Pond tests, Oreg	(*109*)
Phragmites communis (Phragmites)						
2,4-D + dalapon		6 lb	Water	None at 3 months	Treated June 15, hand spray, Ariz.	(*226*)
TCA		200 to 250 lb		Fair to good	Dewatered area	(*174*)
Dalapon		10 lb	Water	95 percent	Treated June 15, plants intermittently under water.	(*241*)
		20 to 50 lb	do	Complete kill	do	(*241*)
		22 lb	do	5 percent at 3 months	Treated May 15, hand spray, Ariz.	(*226*)
		11 lb	do	90 percent at 3 months	Treated July 15, hand spray, Ariz.	(*226*)
		2.5 to 3 lb	do		Ponds in Israel, wetting agent, .2 percent; recommended rate.	(*201*)
		20 lb	Water, 265–500 gal.	70 percent	Treated in Dec., spray, Calif	(*126*)
		40 lb	do	92 percent	do	(*126*)
		60 lb	do	93 percent	do	(*126*)
		15 lb	do	97 percent	do	(*126*)

Dalapon—Continued		30 lb	Water	98 percent	Treated in spring and summer, spray, Calif.	(126)
		45 lb	do	do	do	(126)
		15 lb	do	100 percent	Treated in Oct., spray, Calif.	(126)
		30 lb	do	do	do	(126)
		45 lb	do	do	do	(126)
		15 to 20 lb	Water, 100 gal		Numerous field testings; recommended rate.	(212)
		10 lb	Water	Fair	Refuge, nonflooded test, plots in Del.	(217)
		15 lb	do	do	do	(217)
		20 lb	do	do	do	(217)
		30 lb	do	Effective	do	(217)
Dalapon + amitrole		15 lb.+2 lb	Water	Effective	Dewatered areas	(211)
Monuron		50 lb	Water	70 percent	Sprayed in flowering stage, Mass.	(226)
		25 lb	Dust	95 percent	Treated July 23, hand duster, Mass.	(226)
		60 lb	do	100 percent	Treated in Aug	(224)
		20 lb		Good	Dewatered area	(174)
Neburon		4 lb	Water	None	Refuge, nonflooded test, plots in Del.	(217)
		8 lb	do	do	do	(217)
		16 lb	do	do	do	(217)
		24 lb	do	do	do	(217)
Amitrole		2 lb	Water	Fair	Refuge, nonflooded test, plots in Del.	(217)
		4 lb	do	Good	do	(217)
		15 lb	do	Effective	do	(217)
Amitrole + 2,4-D		4 lb. +6 lb	Water	Good	Treated July 31, sprayed, Minn.	(226)
Amitrole + dalapon		10 lb. +2 lb	do	Effective	Refuge, nonflooded test, plots in Del.	(217)
Erbon		15 lb	Water	Good	Refuge, nonflooded test, plots in Del.	(217)
		25 lb	do	do	do	(217)
Simazine		10 lb	Water	None	Refuge, nonflooded test, plots in Del.	(217)
Aromatic oils		500 to 600 gal. (each).		Good	2 treatments per year for 3 years.	(174)
Sodium chlorate		200 to 300 gm./10 sq. meters.	Water		Ponds in Israel; recommended rate.	(201)
2,3-dichloroisobutyrate		35 lb	do	None	Refuge, nonflooded test, plots in Del.	(217)
Phragmites maximus (Reedgrass)						
2,4-D, PGBEE		4.8 lb	Diesel fuel	90–100 percent	Pond tests	(210)
2,4-D, IPE		4 to 8 lb	do	do	do	(210)
Dalapon		10 lb	Water	Resistant	do	(210)
Monuron		50 lb		100 percent	Research trials, refuges	(97)
Diuron		65 lb	Water	Complete kill	Dewatered pond area, 21 months.	(210)
Amitrole		20 lb	do		Based on pond tests; recommended rate.	(210)
Amitrole + TCA		3.4 lb. + 21.6 lb	do	98 percent	Pond tests	(210)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Phragmites maximus (Reedgrass)—Continued						
Amitrole + dalapon		2 lb. + 15 lb	Water	Satisfactory	Research trials, nonflooded site, Del.	(*97*)
		8 lb. + 25 lb	do	do	do	(*97*)
Erbon		25 lb	Water	Satisfactory	Research trials, nonflooded site, Del.	(*97*)
Polygonum spp. (Smartweeds)						
2,4-D		1 to 1½ lb	Water	Inconsistent	Sugarcane field	(*115*)
	1 percent				Ponds; recommended rate	(*232*)
		3.34 lb	Water	50 percent	Treated July 7, Wis	(*101*)
		80 to 100 lb	Granules	Complete	Treated May 7, checked June 24, pond tests, Ark.	([3])
2,4-D, PGBEE		4.8 lb	Diesel fuel	90–100 percent	Pond tests	(*210*)
2,4-D, BE	1 percent		Water	Good	do	(*149*)
	0.5 percent		Diesel fuel	Good to excellent	do	([2])
2,4-D, IPE	0.5 percent	6 to 8 lb	Diesel fuel	Good	Pond tests	([2])
		4 to 8 lb	do	90–100 percent	do	(*210*)
TCA+silvex		10 lb.+20.8 lb	Water	98 percent	Pond tests	(*210*)
Dalapon		10 lb	do	Susceptible	do	(*210*)
Monuron	10 p.p.m			Killed	Pond tests, Oreg	(*210*)
Diuron		65 lb	Water	Complete kill	Dewatered pond bottom, 21 months.	(*210*)
Amitrole		10 lb	do		Based on pond tests; recommended rate.	(*210*)
Amitrole+TCA		3.4 lb.+21.6 lb	do	98 percent	Pond tests	(*210*)
Amitrole+dalapon		5 lb.+5 lb	do	97 percent	do	(*210*)
Amitrole+erbon		3.4 lb.+20.8 lb	do	96 percent	do	(*210*)
Erbon		10.4 lb	Diesel fuel	90 percent	do	(*210*)
Sodium arsenite	8 p.p.m			Complete kill	Pond tests, 3 months	([2])
	8 p.p.m			Good for 2 months	Pond with high iron concentration.	([2])
Polygonum hydropiperoides (Waterpepper)						
Monuron		24 lb		50 percent	Pond test, N.J., 3 months	(*159*)
		48 lb		75 percent	do	(*159*)
Diuron		24 lb		75 percent	Pond test, N.J., 3 months	(*159*)
		48 lb		95 percent	do	(*159*)

Pontederia cordata (Pickerelweed)

2,4-D	----------	12 lb	Water+Tween-20	Resistant	Single application, plants in 2 feet of water.	(*224*)
	----------	12 lb	Water+Dupont W-S.	do	do	(*224*)
2,4-D, amine	0.25 percent	----------	Water+Tide	100 percent at any stage of growth.	Pond tests	(2)
2,4-D, ester	----------	4.2 lb	Kerosene	85 percent	Treated Sept. 26, 1957, Fla	(*121*)
2,4-D, BE	0.1 percent	----------	Diesel oil	100 percent at any stage of growth.	Pond tests	(2)
	0.1 percent	----------	Water	Excellent	do	(2)
	0.1 percent	----------	do	Very susceptible	do	(*104*)
2,4-D, IPE	0.25 percent	4 to 6 lb	Water	Excellent	Pond tests	(2)
	0.1 percent	2 to 4 lb	Diesel fuel	Good	do	(2)
	0.25 percent	----------	Diesel oil	100 percent at any stage of growth.	do	(2)
2,4,5-T	0.1 percent	----------	Diesel oil	100 percent at any stage of growth.	Pond tests	(2)
Silvex, PGBEE	1 p.p.m	----------	Water	Satisfactory	Pond tests, NE	(*148*)
Silvex, IOE	2 p.p.m	----------	----------	do	do	(*148*)
Dalapon	----------	5 to 30 lb	Water	None	Plants in ricefield, not flooded	(*241*)
	----------	20 lb	Water, 11 gal	Unsatisfactory	Research trials, SE	(*99*)
Monuron	----------	50 lb	----------	95 percent	Pond tests, N.J	(*159*)
	----------	75 lb	----------	do	do	(*159*)
	----------	100 lb	----------	do	do	(*159*)
	----------	125 lb	----------	do	do	(*159*)
Benoclor 3C	----------	750 gal./35 acres +700 gal./25 acres.	----------	Satisfactory	Pond tests, N.J	(*246*)
Copper sulfate	3 p.p.m	----------	----------	None	Pond tests	(*118*)
	3 p.p.m	----------	----------	do	do	(*206*)
	----------	300 lb	----------	Resistant	Pond tests, N.J., 8 percent maximum area treated at one time.	(*159*)
	----------	500 lb	----------	do	do	(*159*)
2,3,6 TBA	----------	1.5 to 15 lb	Water	None	Plants treated May 11, plots not under water.	(*241*)
HCA	----------	80 lb	Kerosene	85 percent	Treated Sept. 26, 1957, Fla	(*121*)
Esteron 2,4,5-T	----------	6.4 lb	Water+Tide	80 percent	Treated Dec. 17, 1957, Fla	(*121*)

Ranunculus sp. (Marshmarigold)

2,4-D, ester	10 p.p.m	----------	----------	Killed	Pond tests, N.J	(*159*)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Sagittaria subulata (Arrowhead)

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
2,4-D, isopropanolamine		40 lb		Ineffective	Pond tests, NE	(*141*)
2,4-D		1.5 lb	Water	Killed	Ricefields, La	(*200*)
	1 percent				Ponds; recommended rate	(*232*)
2,4-D, TEA		3 lb	Water	Moderately resistant	Lake tests, TVA	(*147*)
2,4-D, BE	0.05 percent		Diesel fuel	Eradicated	Pond tests	(2)
	0.1 percent	8 lb	Water + 2% Tide	Excellent kill	do	(2)
	0.5 percent		Water	Good kill	do	(*149*)
	0.1–0.2 percent.		do	Fairly resistant	do	(*104*)
		2.4 lb	Kerosene	Moderately resistant	Lake tests, TVA	(*147*)
2,4-D, ME		3 lb	Kerosene	Moderately resistant	Lake tests, TVA	(*147*)
2,4-D, IPE	0.5 percent	4 to 6 lb	Water + Tide	Fair to good	Pond tests	(2)
	0.5 percent	2 to 4 lb	Diesel fuel	Excellent	do	(2)
	0.25 percent	4 to 6 lb	do	Good	do	(2)
2,4-D, Na salt	0.1 percent		Water	No kill	Pond tests, late in season	(2)
2,4,5-T	0.3 percent		do	Good	Pond tests	(*175*)
Silvex	0.3–0.5–0.8 p.p.m.			100 percent	Pond tests, Mass	(*123*)
		4 lb		Satisfactory	Research trial, spray, N.J	(*97*)
Silvex, IOE	2 p.p.m			Satisfactory	Pond tests, NE	(*148*)
Monuron	4.6 p.p.m	25 lb		90 percent	Pond tests, N.J	(*159*)
	9.2 p.p.m	50 lb		95 percent	do	(*159*)
	15.4 p.p.m	100 lb		100 percent	do	(*159*)
Erbon	1 p.p.m			Unsatisfactory	Research trials, N.H	(*97*)
AMS		400 lb	Water + Vatsol OS.	Killed leaves	Pond tests; plants recovered	(*103*)
Delrad 70	2 p.p.m			Unsatisfactory	Research trials, N.H	(*97*)

Salix spp. (Willows)

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
2,4-D, ester	1 percent		Fuel oil	Killed	Painted on stumps	(*239*)
2,4-D, acid		1 to 2 lb	Water	Suppressed growth		(*239*)
2,4-D		80 to 100 lb	Granules	None to partial	Treated May 7, checked June 24, black willow, pond tests, Ark.	(3)
2,4-D+2,4,5-T	1 percent + 1 percent.		Fuel oil	Killed	Painted on stumps	(*239*)
2,4,5-T		3.5 lb	Water	95 percent	Treated Aug. 1, Ill	(*225*)
Monuron	5 p.p.m			Killed	Pond tests, Oreg	(*109*)
	10 p.p.m			do	do	(*109*)
Diuron	2.5 p.p.m			Injured	Pond tests, Oreg	(*109*)
	5 p.p.m			Killed	do	(*109*)
	10 p.p.m			do	do	(*109*)
AMS		100 lb	Water, 125 gal	100 percent	Treated July 18, Vt	(*226*)
Polybor-chlorate		8 lb	Dust	20 percent	Treated July 25, Ky	(*225*)

Salix spp. (Willows) (Continued)

A—*S. interior* (*S. longifolia*)
B—*S. amygdaloides*
C—*S. lucida*
D—*S. discolor*
E—*S. exiqua*
F—*S. cordata*
G—*S. lutea*
H—*S. caroliniana*
I—*S. alba*

[Species indicated by letters in "Remarks" column]

2,4-D, ester	10–12 percent		Diesel oil	Killed all leaves	Treated July 21, sprayed, B, C, D, E present.	(*101*)
		3 lb	Diesel oil, 9 gal	95 percent	Treated June 20, airplane, E, F, G present.	(*224*)
2,4-D		1.4 lb. (each)	Water, 2 gal. (each).	80 percent	Treated June 27 and July 29, airplane, A present.	(*224*)
		8.4 lb	Diesel oil, 11 gal	50 percent	Treated July 18, airplane, evaluated 1 year later, H present.	(*241*)
2,4-D+2,4,5-T		4.2 lb.+4.2 lb	Diesel oil, 5.5+5.5 gal.	60 percent	Treated July 18, airplane, evaluated 1 year later, H present.	(*241*)
2,4-D+2,4,5-T (1:1)		3.57 lb	Diesel oil	Fair	Treated Aug. 3, airplane	(*224*)
		4 lb	Diesel oil, 4 gal	95 percent	Treated July 1, airplane, Minn., marsh and upland treatment.	(*226*)
		2 lb	Diesel oil, 3 lbs., water 40 gal.	75 percent	Treated June 1 and Sept. 30, sprayed, Mich.	(*226*)
2,4-D+2,4,5-T		2 lb	Diesel oil + water (1:7).	100 percent	Treated June 25, airplane, Wis., F present.	(*226*)
		7.44 lb	Water	70–75 percent	Treated June 4, and Sept. 1, sprayed, Fla.	(*226*)
		4 lb	Water, 100 gal	95 percent	Treated Aug. 4, sprayed	(*224*)
2,4,5-T	10 percent		Diesel oil	100-percent wilted	Treated June 28, hand sprayed, A present.	(*101*)
	12 percent		do	do	Treated July 5, hand sprayed, A present.	(*101*)
		6 lb	do	95 percent	Treated July 11, hand sprayed, Ill.	(*226*)
		8.4 lb	Diesel oil, 11 gal	85 percent	Treated July 18, airplane, 1 year, H present.	(*225*)
Silvex		4 lb	Diesel oil, 11 gal	None	Treated July 18, airplane, 1 year, H present.	(*225*)
		8 lb	do	25 percent	do	(*225*)
2,3,6 TBA		4 to 8 lb	Diesel oil	99 percent	Basal spray	(*101*)
		1. 5 lb	Diesel oil	None	Basal spray	(*101*)
		3 lb	Diesel oil, 11 gal	10 percent	Treated July 18, airplane, 1 year, H present.	(*225*)
		9 lb	do	25 percent	do	(*225*)
		15 lb	do	50 percent	do	(*225*)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Salix spp. (Willows) (Continued)

A—shining
B—peach-leaved
C—pussy
D—sandbar
E—long-beaked
F—heart-shaped
G—black
H—silky
I—hoary
J—coyote
K—whiplash

[Species indicated by letters in "Remarks" column]

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
2,4-D		6.68 lb	Water, 50 gal	20 percent	Treated Apr. 23, S.C	(*225*)
		3.34 lb	Water	Good	Treated July 26, sprayed, Wis., A, B, C, D present.	(*224*)
2,4-D, amine		4 lb	Water	60–80 percent	Treated June 13, airplane, Wis., A, B, C, D present.	(*226*)
		2 lb	do	90 percent	Treated July 22, airplane, Idaho.	(*226*)
2,4-D, IPE		3.34 lb	Diesel oil, 12 gal	Good	Treated July 5, airplane, Oreg.	(*241*)
		5 lb	Diesel oil	Negative	Treated June 29, airplane, La., G present.	(*241*)
2,4-D+2,4,5-T (9:5)		3 lb	Diesel oil, 3 gal	95–100 percent	Treated June 12, airplane, Ill.	(*241*)
2,4-D+2,4,5-T (1:1)		3.8 lb	Diesel oil, 10 gal	Good initial kill; regrowth.	Treated June 5, airplane, Wis., C, D, E present.	(*241*)
		3.15 lb	Diesel oil, 7 gal	95–100 percent	Treated July 9, airplane, Minn., C, D, E, G present.	(*241*)
		3 lb	do	95 percent	Treated June 26, airplane, Mich., A, C, H, I present.	(*241*)
		4 lb	Water, .5 gal., diesel oil, 5 gal.	90 percent	Treated July 27, Mich., sprayed.	(*241*)
2,4-D+2,4,5-T (2:1)		3.34 lb.+0.83 lb. (each).	Diesel oil, 1 gal	75 percent	Treated July 14 and 17, airplane, Mo., D, G present.	(*241*)
2,4-D+2,4,5-T		3.34 lb.+3.34 lb		90 percent	Treated Aug. 9, airplane, Wis., A, B, C, D present.	(*241*)
		1.8 lb	Diesel oil	95 percent	Treated June 8, airplane, Minn.	(*241*)
		1.7 lb.+0.96 lb	Fuel oil	do	Treated June 18, aircraft, Ill.	(*241*)
		2.2 lb.+0.92 lb. (each).	Water	do	Treated July 10 and Sept. 5, sprayed, Ill.	(*226*)
		2 lb	Diesel oil+water (1:7).	100 percent	Treated June 25, airplane, Wis., C, D present.	(*226*)
		3.34 lb.+0.83 lb	Water, 27 gal	do	Treated July 2, sprayed, Mo., D, G present.	(*226*)
		3.34 lb.+0.83 lb	Diesel oil, 3 gal	90 percent	Treated July 9, airplane, Mo., D, G present.	(*226*)
2,4-D+2,4,5-T (1:1)		4 lb	Diesel oil, 4 gal	95 percent	Treated July 1, airplane, Minn., marsh and upland treatment, C present.	(*226*)
2,4-D, LV+2,4-D, IPE		4 lb.+3.34 lb	Diesel oil, 8 gal	Complete on J, partial on K.	Treated June 23, airplane, Oreg.	(*226*)
2,4,5-T		6 lb	Diesel oil	90 percent	Treated July 1–12, sprayed, Ill.	(*226*)
AMS		100 lb	Water	100 percent	Treated July 17, sprayed, Vt., G present.	(*226*)

Salix nigra (Willow)						
2,4-D, amines		3 lb	Oil	Effective	Aerial application, may have to extend over 2–3 years.	(*174*)
2,4-D, esters		3 lb	do	do	do	(*174*)
2,4-D	0.6 percent		Water+detergent.		Foliage spray; recommended rate.	(*215*)
2,4-D, TEA	0.5 percent	1 lb	Water	Satisfactory	Lake tests	(*147*)
	0.5 percent	3 lb	do	do	do	(*147*)
2,4-D, BE	0.25 percent		Diesel fuel	Killed	Pond tests	(2)
2,4-D, ME	0.5 percent	1 lb	Water	Satisfactory	Lake tests	(*147*)
	0.5 percent	3 lb	do	do	do	(*147*)
2,4-D, IPE	0.5 percent	6 to 8 lb	Diesel fuel	Good	Pond tests	(2)
2,4-D, Na salt	0.5 percent	1 lb	Water	Satisfactory	Lake tests	(*147*)
	0.5 percent	3 lb	do	do	do	(*147*)
2,4-D+2,4,5-T	0.5 percent+0.5 percent.		Water, 100 gal.+3% diesel oil.	95 percent	Treated Apr. 28, sprayed	(*101*)
2,4-D or 2,4,5-T	0.5 percent				Recommended rate	(*232*)
2,4,5-T		3 lb	Oil	Not too effective	Aerial application	(*174*)
	0.3 percent		Water+2% Tide	Good	Pond tests	(*175*)
AMS		300 lb	Water+Vatsol OS	Killed	Pond tests	(*103*)
		100 to 300 lb	Water+detergent.	Killed tops; regrowth	do	(*103*)
		75 to 150 lb	do		Foliage spray; recommended rate.	(*215*)
Saururus cernuus (Lizardtail)						
2,4-D, PGBEE		4.8 lb	Diesel fuel	90–100 percent	Pond tests, Ala	(*210*)
2,4-D, BE	4 percent		Water or kerosene	Good	Pond tests, TVA	(*147*)
2,4-D, ME	5 percent	3 lb		Satisfactory	Lake tests, TVA	(*147*)
	0.5 percent		Water	Slight	do	(*147*)
2,4-D, IPE		4 to 8 lb	Diesel fuel	90–100 percent	Pond tests, Ala	(*210*)
2,4-D, Na salt	0.5 percent	3 lb	Water	Good	Pond tests, TVA	(*147*)
2,4-D, TBP	5 percent		Kerosene	Good kill	Pond tests, Va	(*231*)
Silvex		10.4 lb	Diesel fuel	88 percent	Pond tests, Ala	(*210*)
		83.2 lb	do	80 percent	do	(*210*)
Diuron		62 lb	Water	Eradicated	Dewatered pond bottom, 21 months.	(*210*)
Erbon		10.4 lb	Diesel fuel	90 percent	Pond tests, Ala	(*210*)
Amitrole		10 lb	Water		Pond tests, Ala.; recommended rate.	(*210*)
Amitrole+dalapon		5 lb.+5 lb	do	97 percent	Pond tests, Ala	(*210*)
Scirpus spp. (Bulrushes)						
2,4-D, low volatile ester		4 lb. (each)	Diesel oil, 4 gal	Good	2 applications, airplane, Oreg. (hardstem).	(*226*)
2,4-D		80 to 100 lb	Granules	Complete	Treated May 7, checked June 24, pond tests, Ark.	(3)
2,4-D, BE		2 lb	Water	95 percent	Treated July 1, airplane, *S. acutus*.	(*101*)
Silvex	1 p.p.m			Poor	Only control from spray contact, pond tests, N.J., *S. americanus*.	(*252*)
	2 p.p.m			90–100 percent	Pond tests, N.J., 3–4 weeks	(*252*)
Copper sulfate	3 p.p.m			No effect	Pond tests	(*206*)
	3 p.p.m			do	do	(*118*)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Scirpus californicus (Saltgrass)						
2,4-D		6.68 lb	Water	100 percent	Plants in water	(*240*)
Scirpus rubricosus (*S. eriophorum*) (Woolgrass)						
2,4-D, TEA		3 lb	Water	Resistant	Lake tests, TVA	(*147*)
2,4-D, PGBEE		4.8 lb	Diesel fuel	90–100 percent	Pond tests	(*210*)
2,4-D, BE		2.4 lb	Water	Resistant	Lake tests, TVA	(*147*)
2,4-D, ME		3 lb	do	do	do	(*147*)
2,4-D, IPE		4 to 8 lb	Diesel fuel	90–100 percent	Pond tests	(*210*)
2,4-D, Na salt		3 lb	Water	Resistant	Lake tests, TVA	(*147*)
Silvex		10.4 lb		88 percent	Pond tests	(*210*)
		83.2 lb		80 percent	do	(*210*)
TCA+silvex		10 lb.+20.8 lb	Water	98 percent	Pond tests	(*210*)
Dalapon		10 lb	do	Resistant	do	(*210*)
Diuron		65 lb	do	Complete kill	Dewatered pond bottom, 21 months.	(*210*)
Erbon		10.4 lb	Diesel fuel	90 percent	Pond tests	(*210*)
Amitrole		20 lb	Water	Failed to kill	do	(*210*)
Amitrole+dalapon		5 lb.+5 lb	do	Poor kill	do	(*210*)
Amitrole+kuramine		6.8 lb.+20.8 lb	do	90 percent	do	(*210*)
Scirpus validus (Soft-stem bulrush)						
2,4-D	1 percent		Oil		Ponds; recommended rate	(*232*)
2,4-D, TEA	15 percent		Water	Killed	Pond tests (round stem)	(*231*)
2,4-D, TBP	5 percent		Kerosene	Good kill	do	(*231*)
	5 percent			Tops killed in 3 weeks	Pond tests	(*122*)
2,4-D, BE	1 percent		Water	Good	Pond tests	(*149*)
	0.25 percent		Diesel fuel	95 percent	do	(2)
2,4-D, IPE	0.25 percent	2 to 4 lb	Diesel fuel	Fair to good	Pond tests	(2)
	0.5 percent	6 to 8 lb	do	Good	do	(2)
2,4,5-T	0.3 percent		Water+.2% Tide	Good	Pond tests	(*175*)
Amitrole		10 to 20 lb	Water	Killed in 1 year; regrowth 2d year.	do	(*113*)
Erbon		10 to 15 lb	Diesel fuel	Partial	do	(2)
Sodium arsenite	16 p.p.m			No kill of roots	do	(*230*)
	5 percent			None	do	(*170*)

Sparganium spp. (Burreed)						
Silvex	1 p.p.m			Promising	Research trials, N.J	(*97*)
Sparganium americanum or *eurycarpum* (Burreed)						
2,4-D	1 percent				Ponds; recommended rate	(*232*)
2,4-D, ester	0.6–0.7 percent.		Water		Ponds in Israel; recommended rate.	(*201*)
2,4-D, TEA	15 percent		do	Killed	Pond tests	(*230*)
2,4-D, BE	0.5 percent		do	Good	do	(*149*)
Monuron	5 p.p.m			do	Pond tests, Oreg	(*109*)
Diuron	5 p.p.m			do	do	(*109*)
Sparganium angustifolium (Burreed)						
2,4-D, ester	10 p.p.m			None	Pond tests, N.J	(*159*)
	15 p.p.m			do	do	(*159*)
	20 p.p.m			do	do	(*159*)
Monuron	4.6 p.p.m	25 lb		90 percent	Pond tests, N.J	(*159*)
	9.2 p.p.m	50 lb		95 percent	do	(*159*)
	15.4 p.p.m	100 lb		100 percent	do	(*159*)
		75 lb		95 percent	do	(*159*)
		125 lb		100 percent	do	(*159*)
Copper sulfate		300 lb		Resistant	Pond tests	(*159*)
		500 lb		do	do	(*159*)
Spartina bakeri (Baker's cordgrass)						
Dalapon		5 lb	Water	15 percent	Treated May 14, plots on moist soil that had been burned.	(*101*)
		7.5 lb	do	75 percent	do	(*101*)
		10 lb	do	do	do	(*101*)
		12.5 lb	do	80 percent	do	(*101*)
		15 lb	do	do	do	(*101*)
		17.5 lb	do	70 percent	do	(*101*)
		20 lb	do	80 percent	do	(*101*)
		22.5 lb	do	do	do	(*101*)
		25 lb	do	70 percent	do	(*101*)
		30 lb	do	99 percent	do	(*101*)
		5 lb. + 5 lb	do	90 percent	Treated May 5 and July 23, plots on moist soil.	(*101*)
		5 lb. + 10 lb	do	do	do	(*101*)
MH		5 to 20 lb	Water	Poor to fair	Treated May 5 and July 23, plots on moist soil.	(*101*)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Spartina cynosuroides (Cordgrass)						
Dalapon	----------	5 to 30 lb	Water	Ineffective	Treated May 10, plants not flooded.	(*101*)
	----------	50 lb	Water, 200 gal	95 percent	Air treatment in July, plants 7 feet high and dense, refuge.	(*242*)
	----------	30 lb	do	do	do	(*242*)
	----------	20 lb	do	90 percent	do	(*242*)
	----------	10 lb	do	50 percent	do	(*242*)
Dalapon+amitrole	----------	20 lb.+10 lb	Water, 200 gal	99 percent	Air treatment in July, plants 7 feet high and dense, refuge.	(*242*)
2,3,6 TBA	----------	3 to 30 lb	Water	Ineffective	Treated May 16, plot not under water.	(*241*)
Spartina patens (Saltmeadow cordgrass)						
Dalapon	----------	5 lb. (each)	----------	75 percent	Treated Apr. 20 and June 11, surface water.	(*101*)
	----------	7.5 lb. (each)	----------	85 percent	do	(*101*)
	----------	10 lb. (each)	----------	95 percent	do	(*101*)
	----------	12. 5 lb	----------	10 percent	Treated Apr. 20, plots with surface water.	(*101*)
	----------	15 lb	----------	do	do	(*101*)
	----------	17.5 lb	----------	25 percent	do	(*101*)
	----------	20 lb	----------	40 percent	do	(*101*)
	----------	22.5 lb	----------	50 percent	do	(*101*)
	----------	25 lb	----------	do	do	(*101*)
	----------	27.5 lb	----------	97 percent	do	(*101*)
	----------	30 lb	----------	70 percent	do	(*101*)
	----------	15 lb	Water	80 percent	Treated June 11, plots with surface water.	(*101*)
	----------	17.5 lb	do	do	do	(*101*)
	----------	20 lb	do	85 percent	do	(*101*)
	----------	22.5 lb	do	90 percent	do	(*101*)
	----------	25 lb	do	do	do	(*101*)
	----------	27.5 lb	do	92 percent	do	(*101*)
	----------	30 lb	do	95 percent	do	(*101*)
	----------	5 lb (each)	do	90 percent	5 applications, May 14 to June 27, sprayed established growths.	(*100*)
	----------	5 lb. (each)	do	85 percent	3 applications, May 14 to June 11, sprayed established growths.	(*100*)
	----------	5 lb. (each)	do	do	3 applications, May 14 to May 19, sprayed established growths.	(*100*)

Dalapon—Continued	----------	5 lb. (each)	do	80 percent	2 applications, May 14 and May 22, sprayed established growths.	(*100*)
	----------	5 lb. (each)	do	do	2 applications, May 14 and May 29, sprayed established growths.	(*100*)
	----------	5 lb	do	60 percent	1 application, May 14, sprayed established growths.	(*100*)
	----------	5 lb. (each)	do	90 percent	4 applications, May 14 to June 4, sprayed, plot 1, burned.	(*242*)
	----------	5 lb. (each)	----------	do	4 applications, May 14 to June 27, plot 2, burned.	(*242*)
	----------	5 lb. (each)	----------	85 percent	3 applications, May 14 to May 29, plot 3, burned.	(*242*)
	----------	5 lb. (each)	----------	90 percent	3 applications, May 14 to June 11, plot 4, burned.	(*242*)
	----------	5 lb. (each)	----------	85 percent	2 applications, May 14 and May 22, plot 5, burned.	(*242*)
	----------	5 lb. (each)	----------	do	2 applications, May 14 and May 29, plot 6, burned.	(*242*)
	----------	5 lb	----------	60 percent	1 application, May 14, plot 7, burned.	(*242*)
	----------	None in 1958	----------	90 percent	Rechecked 15 months after treatment, plot 1, refuge.	(*242*)
	----------	do	----------	do	Rechecked 15 months after treatment, plot 2.	(*242*)
	----------	do	----------	25–40 percent	Rechecked 15 months after treatment, plot 3.	(*242*)
	----------	do	----------	10 percent	Rechecked 15 months after treatment, plot 4.	(*242*)
	----------	do	----------	5–10 percent	Rechecked 15 months after treatment, plot 5.	(*242*)
	----------	do	----------	None	Rechecked 15 months after treatment, plot 6.	(*242*)
	----------	do	----------	do	Rechecked 15 months after treatment, plot 7.	(*242*)
	----------	5 lb. (each)	----------	90 percent	5 applications in 1957, plot 8, not burned before treatment, refuge.	(*242*)
	----------	None in 1958	----------	20 percent	Rechecked 15 months after treatment, plot 8, refuge.	(*242*)
	----------	5 lb	----------	60 percent	Treated June 25, checked in Oct. 1958.	(*242*)
	----------	20 lb	----------	90 percent	do	(*242*)
	----------	5 lb. (each)	----------	do	Treated June 25, July 16, and July 29, checked in Oct. 1958.	(*242*)
	----------	5 lb. (each)	----------	80 percent	Treated June 25 and July 16, checked Oct. 1958.	(*242*)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Spartina patens (Saltmeadow cordgrass)—Continued						
Amitrole		5 lb. (each)		None	Treated June 25, and July 16, checked Oct. 1958.	(*242*)
		3 lb. (each)		do	do	(*242*)
		5 lb. (each)		50–60 percent	Treated June 25, July 16, and July 29, checked in Oct. 1958.	(*242*)
		3 lb. (each)		40 percent	do	(*242*)
		1 lb. (each)		10 percent	do	(*242*)
		3 lb		None	Treated June 25, checked in Oct. 1958.	(*242*)
		5 lb		40 percent	do	(*242*)
		20 lb		None	do	(*242*)
		1 lb		do	Treated June 25, checked in Oct. 1958, 400 sq. ft., plots in refuge.	(*242*)
		1 lb. (each)		do	Treated June 25 and July 16, checked in Oct. 1958, 400 sq. ft., plots in refuge.	(*242*)
Amitrole+dalapon		10 lb.+10 lb		80 percent	Treated June 25, checked in Oct. 1958, 400 sq. ft. plot, refuge.	(*242*)
		5 lb.+10 lb		60 percent	do	(*242*)
		3 lb.+10 lb		do	do	(*242*)
		2 lb.+3 lb		55 percent	do	(*242*)
		1.5 lb.+2 lb		40 percent	do	(*242*)
		10 lb.+3 lb		50 percent	do	(*242*)
		5 lb.+5 lb		60 percent	do	(*242*)
Spartina spartinae (Cordgrass)						
2,4-D, PGBEE		4.8 lb	Diesel fuel	90–100 percent	Pond tests	(*210*)
2,4-D, IPE		4–8 lb	do	do	do	(*210*)
Silvex		10.4 lb		88 percent	do	(*210*)
		83.2 lb		80 percent	do	(*210*)
TCA+silvex		10 lb.+20.8 lb	Water	98 percent	Pond tests	(*210*)
Dalapon		10 lb	do	Partial	do	(*210*)
Monuron		12–15 lb	do	Very effective		(*250*)
Amitrole		20 lb	do		Ponds; recommended rate	(*210*)
Amitrole+erbon		3.4 lb.+20.8 lb	do	96 percent	Pond tests	(*210*)
Erbon		10.4 lb	Diesel fuel	90 percent	do	(*210*)

Spartina × *townsendii* (Cordgrass)

Dalapon	----------	20 lb	Water, 100 gal	76 percent; complete recovery in 2 years.	11 months, England	(*194*)
	----------	30 lb	do	48 percent; complete recovery in 2 years.	do	(*194*)
	----------	40 lb	do	84 percent; complete recovery in 2 years.	do	(*194*)
	----------	50 lb	do	do	do	(*194*)
Fenuron	----------	40 lb	Water, 100 gal	92 percent	3.5 months, England	(*194*)
	----------	60 lb	do	96 percent; 99-percent kill.	15 months, England	(*194*)
Fenuron+2,4-D+sodium borate.	----------	15 lb. (fenuron)	Granules	65 percent	1 year, England	(*194*)
	----------	15 lb. (fenuron)	Water	60 percent	Injected into mud, 1 year, England.	(*194*)
	----------	20 lb. (fenuron)	do	99 percent in part of plot; 10 percent in part.	do	(*194*)
Monuron	----------	20 lb	Granules	27 percent; recovery in 2 years.	11 months, England	(*194*)
	----------	40 lb	do	53 percent; recovery in 2 years.	do	(*194*)
Monuron+sodium borate	----------	250 lb	Granules	69 percent; 40-percent recovery in 2 years.	11 months, England	(*194*)
	----------	500 lb	do	94 percent; 40-percent recovery in 2 years.	do	(*194*)
	----------	1,000 lb	do	20 percent	15 months, England	(*194*)
Diuron (WP)	----------	20 lb	Water, 100 gal	9 percent; strong recovery in 2 years.	11 months, England	(*194*)
	----------	40 lb	do	32 percent; strong recovery in 2 years.	do	(*194*)
	----------	40 lb	do	50 percent	15 months, England	(*194*)
	----------	60 lb	do	70 percent	do	(*194*)

Tamarix gallica (Saltcedar)

2,4-D	----------	2 lb	Water, 200–400 gal.	Excellent	Retreatment necessary, ground spray.	(*239*)
	----------	3 lb	Oil, 15–20 gal	do	Aircraft application	(*239*)

Typha spp. (Cattails)

2,4-D	----------	80–100 lb	Granules	None to complete	Treated May 7, checked June 24, pond tests, Ark.	([3])
	----------	5.01 lb	Diesel oil	90 percent	Treated Apr. 30, airplane, Fla.	(*226*)
2,4-D, IPE	----------	5 lb. (each)	Water, 5 gal	75 percent	Air treatment May 15, June 13, and July 17, checked Oct. 27, refuge.	(*242*)
2,4-D+2,4,5-T	----------	10 lb	Kerosene, 50 gal	80 percent	Treated Sept. 6, 1957, Fla	(*121*)
	----------	2 lb. (each)	Diesel oil, 3 gal	Satisfactory	Research trials, N.Y	(*97*)
Silvex, IOE	2 p.p.m	----------	----------	Satisfactory	Treated June 29, pond tests, NE.	(*148*)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Typha spp. (Cattails)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Dalapon	----------	20 lb	Water, 11 gal	55 percent	Treated May 18, 1956, plot 1, refuge.	(*242*)
	----------	10 and 5 lb	Water, 8 gal	75 percent	Retreated May 23 and June 18, 1957, checked in Oct. 1958, plot 1.	(*242*)
	----------	10 and 5 lb	do	60 percent	Retreated May 23 and June 18, 1957, checked in Oct. 1958, plot 2, refuge.	(*242*)
	----------	20 and 5 lb	Water, 11 gal	do	Treated May 18 and June 20 1956, checked in May 1957, plot 3, refuge.	(*242*)
	----------	10 and 5 lb	Water, 8 gal	80 percent	Retreated May 23 and June 18, 1957, checked in Oct. 1958, plot 3, refuge.	(*242*)
	----------	10 and 5 lb	Water, 11 gal	70 percent	Treated May 18 and June 20, 1956, checked in May 1957, plot 4.	(*242*)
	----------	10 and 5 lb	Water, 8 gal	80 percent	Retreated May 23, and June 18, 1957, checked in Oct. 1958, plot 4.	(*242*)
	----------	10 and 5 lb	do	40 percent	Retreated May 23 and June 18, 1957, checked in Oct. 1958, plot 5.	(*242*)
	----------	20 lb	do	60 percent	Treated May 18, 1956, checked in May 1957, plot 6.	(*242*)
	----------	10 and 5 lb	do	90 percent	Retreated May 23 and June 18, 1957, checked in Oct. 1958, plot 6.	(*242*)
	----------	20 lb	do	97 percent	Airplane, Fla	(*99*)
	----------	20 lb	Water, 5 gal	do	do	(*99*)
	----------	20 lb	Water, 8 gal	99 percent; killed in 4 months.	Air treatment June 7, 10 acres, refuge.	(*242*)
	----------	10 and 5 lb	do	65 percent	Air treatment May 15 and June 9, checked Oct. 22, refuge.	(*242*)
	----------	10 and 5 lb	do	75–98 percent	Air treatment June 13 and July 17, checked Oct. 27, refuge.	(*242*)
	----------	15 and 20 lb	Water	97-percent top kill	Research trials. refuges	(*97*)
	----------	20 lb	Water, 11 gal	95–100 percent	Airplane, Fla	(*99*)
	----------	20 lb	do	97 percent	do	(*99*)
	----------	20 and 5 lb	do	98 and 60 percent	Treated May 18 and June 20, airplane, percent of kill checked in Oct. 1956 and May 1957.	(*223*)
	----------	10 and 5 lb	do	97 and 70 percent	do	(*225*)
	----------	20 lb	do	95 and 55 percent	do	(*225*)
	----------	20 lb	Water, 8 gal	98 and 60 percent	do	(*225*)

Dalapon—Continued	----------	10 and 5 lb	Water, 8 gal	90–95 percent	Treated May 23 and June 18, airplane, 2d year treatment on plots. (226)
	----------	20 lb	do	99 percent	Treated June 18, airplane (226)
	----------	10 and 5 lb	do	do	Treated June 18 and July 16, airplane. (226)
	----------	10 and 5 lb	Water, 11 gal	97 percent	Treated May 18 and June 20, airplane. (225)
	----------	20 lb	Water, 8 gal	98 percent	Treated May 18, airplane (225)
	----------	27 lb	Water	97 percent	Treated May 19, airplane, N.C. (225)
	----------	22 lb	do	None	Treated May 15, sprayed, Ariz., checked in 3 months. (226)
	----------	10 and 5 lb	Water, 8 gal	90–95 percent	Treated May 23 and June 18, airplane, N.C. (226)
	----------	52.4 lb	Water	100 percent	Treated Aug. 8, sprayed, N.Y. (226)
Dalapon+2,4-D	----------	10 lb.+3.34 lb	Water, 11 gal.+ diesel oil, 5 gal.	50 percent	Treated May 18 and June 20, 1956, checked in May 1957, plot 2, refuge. (242)
	----------	20 lb.+3.34 lb	do	60 percent	Treated May 18 and June 20, 1956, checked in May 1957, plot 5. (242)
	----------	10 lb.+3.34 lb	do	85 and 50 percent	Treated May 18 and June 20, 1956, airplane, percent of kill checked in Oct. 1956 and May 1957. (225)
	----------	20 lb.+3.34 lb	do	90 and 60 percent	do (225)
	----------	20 lb.+3.34 lb	Water, 11 gal	90 percent	1st treatment May 18, airplane; 2d treatment June 20. (225)
Dalapon+2,4,5-T	----------	10 lb.+1 lb	Water, 11 gal	50–70 percent	Water less than 10 inches deep, airplane, Fla. (99)
	----------	20 lb.+1 lb	do	80–95 percent	Airplane, Fla (99)
Monuron	----------	15 lb		Unsatisfactory	Research trials, N.H (97)
Amitrole	----------	5 lb	Water, 200–400 gal.	90–100 percent	(211)
	----------	5 lb	Water, 200 gal	100 percent	Not replicated (211)
	----------	3 lb	do	do	do (211)
	----------	2 lb	do	do	do (211)
	----------	3 and 2 lb	Water, 8 gal	85 percent	Air treatment, June 13 and July 17, checked Oct. 27, refuge. (242)
	----------	5 lb	do	80 percent	Air treatment, June 13, checked Oct. 27, refuge. (242)
	----------	10 lb	Water, 16 gal	95 percent	do (242)
	----------	6 lb	Water, 5 gal	85 percent	Air treatment, July 17, 1957, checked in Oct. 1957, refuge. (242)
	----------	5 lb	Water	Satisfactory	Research trials, flooded, F & WS, Del. (97)
	----------	20 lb	do	Whitened leaves	Treated June 22, Calif (225)
	----------	16 and 24 lb	Water+oil	40 percent	Treated Aug. 17 and Aug. 25, sprayed, Ariz. (226)
	----------	4 lb	Water, 6 lb.+ ACP–M–357 and ACP–M–358 detergents.	100-percent top kill	Treated Aug. 13, airplane, Minn. (226)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Typha spp. (Cattails)—Continued						
Amitrole+dalapon		2 lb.+5 lb.	Water, 200–400 gal.	90–100 percent	Flowering through fruiting, ratings made at 12 and 14 months, N.Y., Del., Md., N.C.	(*211*)
		3 lb.+5 lb.	do	do	do	(*211*)
		2 lb.+5 lb.	Water, 5–8 gal.	Satisfactory	Research trials, flooded, F & WS.	(*97*)
AMS X		120 lb.	Water, 200 gal.	80 percent	Treated June 11, 1958, Fla.	(*121*)
2,3,6 TBA		6 lb.	Water	Fair to complete	Treated Aug., sprayed, Minn., control varied with soil density.	(*226*)
Dowpon		51 lb.	Water, 85 gal.	95 percent	Treated Sept. 6, 1957, Fla.	(*121*)
		16 lb.	Water, 100 gal.	do	Treated Sept. 10, 1957, Fla.	(*121*)
Typha angustifolia (Cattail)						
2,4-D, amine salt		3 to 6 lb.	Water	Ineffective	Irrigation canals	(*158*)
2,4-D, esters		3 to 6 lb.	Water	do	do	(*158*)
		6 lb.		Ineffective over long period.	do	(*157*)
2,4-D, EE		4.23 lb.	Water, 350 gal.	50-percent kill	Growing in water, resprayed in 5 weeks.	(*157*)
		4.23 lb.	do	80-percent kill	Growing above waterline, resprayed in 5 weeks.	(*157*)
		4.23 lb.	do	85-percent kill 5 months after treatment started.		(*157*)
		2 lb.		80-percent; less than 20-percent regrowth 2d year.	Not in water continuously	(*157*)
2,4-D, IPE		108.1 lb.		100 percent	Greenhouse tests, ⅔ applied 1st application, checked in 6 weeks after 2d application.	(*181*)
		96.6 lb.		do	do	(*181*)
		59 lb.		do	do	(*181*)
		33.9 lb.		do	do	(*181*)
		25.3 lb.		do	do	(*181*)
		15.4 lb.		do	do	(*181*)
		9.2 lb.		do	do	(*181*)
		7.5 lb.		do	do	(*181*)
		6.1 lb.		do	do	(*181*)
		3.9 lb.		95 percent	do	(*181*)
		3.3 lb.		90 percent	do	(*181*)
		2.7 lb.		85 percent	do	(*181*)
		6 to 8 lb.		Complete kill	Irrigation channels	(*180*)
2,4-D, sodium		13.7 lb.		50 percent	Greenhouse tests, checked 6 weeks after 2d application.	(*181*)
		12.6 lb.		40 percent	do	(*181*)

2,4-D, ester+diesel fuel		3 to 6 lb.+10 gal	Water, 190 gal	Excellent	Irrigation canals	(158)
		4 lb.+10 gal	do	Very good	do	(158)
		6 lb.+10 gal	do	do	do	(158)
		8 lb.+10 gal	do	Excellent	do	(158)
		12 lb.+10 gal	do	do	do	(158)
		4 lb.+10 gal	do	Fair to good	do	(158)
		6 lb.+10 gal	do	do	do	(158)
		8 lb.+10 gal	do	do	do	(158)
		12 lb.+10 gal	do	do	do	(158)
2,4-D, TCA		1.5 and 10 lb	Water, 100 gal. + W/S.	80–90 percent	2 applications per year	(158)
2,4-D, amine+AMS		3 to 6 lb.+20 to 40 lb.	Water+wetter sticker.	Fair to good	Irrigation canals	(158)
2,4-D, amine+TCA		3 to 6 lb.+20 to 40 lb.	do	do	do	(158)
2,4-D+AMS		1.8 lb.+320 lb		Resisted	do	(157)
		2 lb.+40 lb	Water, 80 gal	70 percent; 30-percent regrowth 2d year.	Not in water continuously	(157)
2,4-D, sodium+AMS		3 to 6 lb.+20 to 40 lb.	Water+wetter sticker.	Fair to good	Irrigation canals	(158)
2,4-D, sodium+TCA		3 to 6 lb.+20 to 40 lb.	do	do	do	(158)
2,4,5-T, esters		3 to 6 lb	Water	Ineffective	do	(158)
2,4,5-T	750 p.p.m			do	Heavy stands in irrigation ditches.	(157)
	1,125 p.p.m			do	do	(157)
TCA		109 lb		Ineffective over long period.	Irrigation channels	(157)
		163 lb		do	do	(157)
Dalapon		5 lb. (each)	Water	85 percent	2 applications, 2 weeks apart	(211)
		20 lb	Water, 11 gal	95 and 55 percent	1 application in summer, checked in fall and spring.	(99)
		20 and 5 lb	Water, 11 gal.+ diesel oil, 11 gal.	98 and 60 percent	2 applications, 1 month apart, checked in fall and spring.	(99)
		10 and 5 lb	do	97 and 70 percent	do	(99)
		20 lb	Water, 8 gal	98 and 60 percent	1 application, checked in fall and spring.	(99)
		10 and 5 lb	do	80–85 percent	Air treatment in May and June, 81 acres, refuge.	(98)
		20 lb	do	95 percent	Air treatment in June, 23 acres, refuge.	(98)
Dalapon+2,4-D		10 and 3.34 lb	Water, 11 gal.+ diesel oil, 5 gal.	85 and 50 percent	2 applications, 1 month apart, checked in fall and spring, 2,4-D last.	(99)
		20 and 3.34 lb	do	90 and 60 percent	do	(99)
Dalapon+amitrole		5 lb.+5 lb	Water	95 percent		(211)
MH		65.4 lb		None	Greenhouse tests, checked 6 weeks after 2d application.	(181)
Amitrole		5 lb	Water	75 percent		(211)
		15 lb	do	95 percent		(211)
		2.7 lb	do	Stunting only	Treated in Aug., sprayed, Minn.	(226)
		8 lb	do	Poor	do	(226)
		16 lb	do	Good	do	(226)
		20 lb	do	do	do	(226)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Typha angustifolia (Cattail)—Continued						
AMS+fenuron		120 lb.+10 lb	Water	10 percent		(*211*)
ATCA		218 lb		50 percent	Based on regrowth following year.	(*157*)
PCP		712 gal		25 percent	Greenhouse tests, checked 6 weeks after 2d application.	(*181*)
Typha domingensis (Cattail)						
2,4-D, ester		3.3 lb	Water	99 percent		(*174*)
2,4-D+wetting agent		4 lb	Water+VL-600 5%-25%.	80-90 percent	Marsh tests, sprayed on plots	(*224*)
		12 lb	do	5-80 percent	Least kill with 25 percent VL-600.	(*224*)
		4 lb	Water+Tergitol 1.5%-7.5%.	100 percent	Marsh tests, sprayed on plots	(*224*)
		12 lb	do	do	do	(*224*)
		4 lb	Water+Tween-20 7.5%.	do	do	(*224*)
2,4-D		4 lb		100 percent; no regrowth in 3 months.	Treated May 21	(*224*)
		4 lb. (each)	Water	99 percent; no regrowth in 6 months.	Treated June 11 and June 24	(*224*)
		5 lb	Diesel oil, 5 gal	90 percent	Treated May 11, June 7, July 11, and Aug. 7.	(*225*)
2,4-D, IPE		5 lb	Diesel oil, 5 gal	90 percent	Treated in May and June	(*225*)
		15 lb	do	80 percent	Air treatment, Apr., May, and July, 97 acres, refuge.	(*98*)
		5 lb. (each)	Diesel oil, 3 gal. (each).	90 percent	3 applications, airplane, Ga., surface water present.	(*226*)
2,4-D+dalapon		3.34 lb.+7.4 lb	Water	90 percent	Treated June 17, sprayed, Ga., surface water present.	(*226*)
Dalapon		20 lb	Water, 8 gal	99 percent	Air treatment, Apr., 7 acres, refuge.	(*98*)
		10 and 5 lb	do	80-85 percent	Air treatment, May and June, 81 acres, refuge.	(*98*)
		20 lb	do	95 percent	Air treatment, June, 23 acres, refuge.	(*98*)
		20 lb	Water, 11 gal	95-100 percent	Treated Apr. 5, airplane, some water coverage.	(*223*)
		20 lb	do	75 percent	Treated Apr. 30, airplane, surface water on areas.	(*225*)
		20 lb	Water, 8 gal	97 percent	do	(*225*)
		20 lb	Water, 5 gal	do	do	(*225*)
		20 lb	Water, 11 gal	95 percent	Treated May 18, airplane, shallow surface water.	(*225*)
		20 and 5 lb	do	98 percent	Treated May 18 and June 20, airplane.	(*225*)
		20 lb	do	100 percent	Airplane treatment	(*99*)

Dalapon+2,4,5-T	----------	10 lb.+1 qt	Water, 11 gal	50–55 percent	Treated Apr. 5, airplane, some water coverage.	(241)
	----------	10 lb.+1 qt	do	65–70 percent	do	(241)
	----------	20 lb.+1 qt	do	80–95 percent	do	(241)
	----------	20 lb.+1 qt	do	90–95 percent	do	(241)
Dalapon+2,4-D	----------	10 lb.+3.34 lb	Water, 11 gal	85 percent	Dalapon applied May 18, 2,4-D applied June 20, airplane.	(225)
MH	----------	5 lb	Water	95-percent top kill	Marsh tests, spraying on plots	(224)
	----------	10 lb	do	97-percent top kill	do	(224)
	----------	20 lb	do	99-percent top kill	do	(224)
	----------	30 lb	do	do	do	(224)
MH+2,4-D	----------	2.5 lb.+12 lb	Water	Complete; 10-percent regrowth in 3 months.	MH applied Mar. 20, 2,4-D, Apr. 5.	(224)
	----------	5 lb.+12 lb	do	Complete; 2-percent regrowth in 3 months.	MH applied Mar. 30, 2,4-D, Apr. 5.	(224)
	----------	10 lb.+12 lb	do	Complete; 2.5-percent regrowth in 3 months.	do	(224)
	----------	20 lb.+12 lb	do	Complete; 1-percent regrowth in 3 months.	do	(224)
	----------	20 lb.+4 lb	do	99 percent; 5-percent regrowth in 3 months.	MH applied May 21, 2,4-D, June 4.	(224)
	----------	5 lb.+4 lb	do	99 percent; no growth in 6 months.	MH applied June 11, 2,4-D, June 24.	(224)
	----------	10 lb.+4 lb	do	do	do	(224)
	----------	20 lb.+4 lb	do	do	do	(224)
	----------	30 lb.+4 lb	do	do	do	(224)
2,3,6 TBA	----------	3 lb	Diesel oil	10 percent; contact kill.	Treated May 5, plots under water.	(241)
	----------	9 lb	do	30 percent; contact kill.	do	(241)
	----------	15 lb	do	80 percent; contact kill.	do	(241)
Typha glauca (Cattail)						
Amitrole	----------	8 lb	Water	Poor	Treated in Aug., sprayed, Minn.	(226)
	----------	2.7 lb	do	Stunting only	do	(226)
	----------	16 lb	do	Good	do	(226)
	----------	20 lb	do	do	do	(226)
Typha latifolia (Cattail)						
2,4-D	----------	1.4 lb	Water, 2 gal	40 percent	Treated June 27, airplane	(224)
2,4-D, ester	----------	4 lb	Water, 50 gal	30 percent	Treated Aug. 11, spray	(224)
2,4-D, amine	----------	4 lb. (each)	Water, 50 gal. (each).	30–40 percent	Treated July 11 and Aug 10, spray.	(224)
2,4-D, Dowanol ester	1 percent	20 lb	Diesel fuel	90–95 percent	Pond tests	(2)
	1 percent	20 lb	Kerosene	do	do	(2)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Typha latifolia (Cattail)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
2,4-D	0.5 percent		Oil		Ponds; recommended rate	(*232*)
2,4-D (20 percent P)		100 lb		Retarded	Pond tests	(*197*)
2,4-D, ester		15.6 lb	Diesel oil, 9.3 gal	80–100 percent	Airplane application	(*174*)
2,4-D		1 lb	Kerosene, 25 gal	Good	2 quarts tributyl phosphate	(*174*)
2,4-D, BEE		6 to 8 lb. (each)	Diesel fuel	do	2 sprayings, 5–6 weeks apart, ground spray.	(*174*)
2,4-D, BE	0.2–0.4 percent.		Water	do	Pond tests (slow acting)	(*104*)
	0.25 percent		Diesel fuel	do	Pond tests	(2)
	1 percent		Water	do	do	(*149*)
	1 percent	10 lb	Diesel fuel	98 percent	do	(2)
	1 percent	10 lb	Kerosene	do	do	(2)
2,4-D, ME		3 lb	Kerosene	Fair to good	Lake tests, TVA	(*147*)
2,4-D, IPE		108 lb		100 percent	Greenhouse tests, ⅔ at first application, checked 6 weeks after 2d application.	(*181*)
		84.1 lb		do		
		55.7 lb		95 percent		
		46.8 lb		100 percent	do	(*181*)
		41.5 lb		do	do	(*181*)
		27.3 lb		do	do	(*181*)
		12 lb		do	do	(*181*)
		9.2 lb		85 percent	do	(*181*)
		7.5 lb		90 percent	do	(*181*)
		7 lb		95 percent	do	(*181*)
		6.3 lb		85 percent	do	(*181*)
		3.4 lb		80 percent	do	(*181*)
		1.4 lb		75 percent	do	(*181*)
		9 to 12 lb	Water	100 percent	Irrigation channels	(*180*)
		5 lb. (each)	Diesel fuel, 5 gal. (each).	80 percent	Air treatment, Apr., May, and July, 97 acres, refuge.	(*98*)
	0.5 percent	8 to 16 lb	Water+.2% dynawet.	Good top kill	Pond tests	(2)
	0.5 percent	8 to 16 lb	Water+.5% Roccal.	do	do	(2)
	0.5 percent	6 to 12 lb	Diesel fuel	Good	do	(2)
		4 to 8 lb	do	90–100 percent	do	(*210*)
2,4-D, sodium salt		17.5 lb		40 percent	Greenhouse tests, checked 6 weeks after 2d application.	(*181*)
		13.1 lb		60 percent	do	(*181*)
		3 lb	Water	Resistant	Lake tests, TVA	(*147*)
2,4-D, Na salt+TCA		1.2 lb.+10 lb	Water	Good	1 quart sulfonate emulsifier, ground spray.	(*174*)
2,4-D, nonvolatile Dow	1 percent	10 lb	Diesel fuel	100 percent	Pond tests	(2)
	1 percent	10 lb	Kerosene	do	do	(2)
2,4-D+2,4,5-T	0.6 percent	2 lb.+2 lb	Water, 60–80 gal	None	Spray application, 2 ponds, field tests, Ga.	(*236*)
	0.6 percent	2 lb.+2 lb	do	100 percent	do	(*236*)

2,4-D+2,4,5-T+dalpon+Tide	----------	1.5 lb.+7.5 lb.+3 lb.	Water, 80 gal	100 percent; killed less than 30 days in fall.	Spray application, 2 ponds, field tests, Ga.	(236)
	----------	1.5 lb.+15 lb.+3 lb.	do	100 percent	Spray application, field tests, Ga.	(236)
	----------	3 lb.+15 lb.+3 lb.	do	do	do	(236)
2,4-D, PGBEE	----------	4.8 lb	Diesel fuel	90–100 percent	Pond tests	(210)
2,4-D, TBP	5 percent	----------	Kerosene	Killed; appeared dead in 10 days.	----------	(122)
2,4-D, TEA	----------	3 lb	Water	Resistant	Lake tests, TVA	(147)
2,4,5-T, ester	0.6 percent	4 lb	Water, 60–80 gal	95 percent	Spray application, pond tests, Ga.	(236)
2,4,5-T	0.3 percent	----------	Water+.2% Tide	Good	Pond tests	(175)
	1 percent	10 lb	Diesel fuel	100 percent	do	(2)
	1 percent	10 lb	Kerosene	98 percent	do	(2)
	----------	1 lb	Water, 100 gal	None	Ditch tests, 15 months	(145)
	----------	2 lb	do	60 percent	do	(145)
	----------	3 lb	do	50 percent	do	(145)
Silvex	0.6 percent	4 lb	Water, 60–80 gal	100 percent	Spray application, pond tests, Ga.	(236)
TCA	1.p.p.m	----------	----------	Poor	Pond tests, N.J., 3–4 weeks	(252)
TCA+2,4-D, IPE	5 percent	168 lb	Water, 200 gal.+1% Tide.	Poor to fair	Pond tests	(2)
TCA+2,4-D, Na salt	5 percent+0.5 percent.	168 lb.+10 lb	do	Very effective	do	(2)
TCA+2,4,5-T	5 percent+1 percent.	168 lb.+33.6 lb	do	Effective	do	(2)
TCA+AMS	5 percent+0.5 percent.	168 lb. +10 lb	do	Very effective	do	(2)
TCA+silvex	5 percent+5 percent.	168 lb.+160 lb	do	Poor to fair	do	(2)
Dalapon	----------	10 lb.+20.8 lb	Water	98 percent	do	(210)
	----------	4 lb	Diesel fuel+water, 4–80 gal.	100 percent	Spray application, pond tests, Ga.	(236)
	----------	16 lb	Water, 80 gal	do	do	(236)
	----------	8 lb	do	do	do	(236)
	----------	10 and 5 lb	Water, 8 gal. (each)	80–85 percent	Air treatment May and June, 81 acres, refuge.	(98)
	----------	2 lb	Water	----------	Ponds in Israel; recommended rate.	(201)
	----------	10 lb	Water, 4 gal	90 percent	Aerial application, growing in less than 8 inches water, Mich.	(152)
	----------	10 lb	do	65 percent	do	(152)
	----------	20 to 25 lb	Water, 100 gal	----------	Suggested for general use	(169)
	----------	10 to 20 lb	Water, 10 gal	Satisfactory	Aerial application	(212)
	----------	6.8 lb	Water, 100 gal	None	Ditch tests, 15 months	(145)
	----------	13.6 lb	do	60 percent	do	(145)
	----------	20.4 lb	do	100 percent	do	(145)
	----------	20 lb	Water	90–99 percent	Pond tests, 8 months	(210)
	----------	10 lb	do	Partial	do	(210)
	1.4 percent	----------	do	Effective	Dewatered area of pond	(2)
	2.0 percent	----------	do	do	do	(2)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Typha latifolia (Cattail)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Dalapon+2,4,5-T		6.8 lb.+1 lb	Water, 100 gal	90 percent	Ditch tests, 15 months	(245)
		6.8 lb.+2 lb	do	do	do	(245)
		6.8 lb.+3 lb	do	80 percent	do	(245)
		13.6 lb.+1 lb	do	100 percent	do	(245)
		13.6 lb.+2 lb	do	do	do	(245)
		13.6 lb.+3 lb	do	do	do	(245)
		20.4 lb.+1 lb	do	do	do	(245)
		20.4 lb.+2 lb	do	do	do	(245)
		20.4 lb.+3 lb	do	do	do	(245)
Monuron	5 p.p.m			Killed	Pond tests, Oreg	(109)
	10 p.p.m			do	do	(109)
		50 lb		50 percent in 22 days; 80 percent in 4 months.	Pond tests, N.J	(159)
		100 lb		do	do	(159)
Diuron	2.5 p.p.m			Injured	Pond tests, Oreg	(109)
MH		80.4 lb		20 percent	Greenhouse tests, checked 6 weeks after 2d application.	(181)
Amitrole		10 lb	Water, 300 gal		Suggested for general use	(169)
		10 lb	Water		Based on pond tests; recommended rate.	(210)
		6 lb	Water, 320 gal	100 percent	Pond tests	(91)
		10 to 12 lb	Water		Pond tests; recommended rate.	(94)
		5 lb	Water, 100 gal	Eradicated	Ditchbank tests	(95)
		5 lb	do		Recommended rate	(93)
		15 to 20 lb	Water		Pond tests; rate required for control.	(96)
		10 to 20 lb	do	Complete	do	(113)
		12 lb	do	39-percent kill	do	(127)
		4 to 8 lb	do	Effective	do	(136)
		20 lb. (each)	do	97 percent	2 applications, pond tests	(138)
		5 lb	do	Complete	Marsh tests	(174)
		8 lb	Water, 100 gal	80-percent top growth		(174)
Amitrole + dalapon		10 lb. + 20 lb	Water		Based on pond tests; recommended rate.	(94)
Amitrole + erbon		3.4 lb. + 20.8 lb	do	96 percent	Pond tests	(210)
Erbon	1.2 percent	8 lb	Water, 60–80 gal	None	Spray application, pond tests, Ga.	(236)
		10.4 lb	Diesel fuel	90 percent	Pond tests	(210)
		10 to 15 lb	do	Partial kill	do	(2)
		10 to 15 lb	Water	Poor kill	do	(2)
		10 to 15 lb	Water + 0.1 percent dynawet.	Killed tops	do	(2)
AMS		150 to 300 lb	Water + detergent.	Killed tops; plants recovered.	Pond tests	(103)
		400 lb	Water + Vatsol OS	Partial kill	do	(103)
AMS+TCA		10 lb. + 10 lb	Water, 200 gal	Unsatisfactory	Pond tests	(2)
Chlorox		400 lb		Complete kill	Pond tests, N.J	(159)
Copper sulfate	2 p.p.m			Unaffected		(230)
	2 p.p.m			do	Hard water	(234)

2,3,6 TBA	----------	2 lb	Water	Stunting only; control varied with soil density.	Treated in Aug., sprayed, Minn.	(226)
	----------	4 lb	do	Poor to good; control varied with soil density.	do	(226)
	----------	6 lb	do	Fair to complete; control varied with soil density.	do	(226)
PCP	----------	571.9 gal	----------	90 percent	Greenhouse tests, checked 6 weeks after 2d application.	(181)
Veronica spp. (Speedwells)						
Monuron	10 p.p.m	----------	----------	Killed	Pond tests, Oreg	(109)
Diuron	5 p.p.m	----------	----------	do	do	(109)
	10 p.p.m	----------	----------	do	do	(109)
Zizaniopsis miliacea (Giant cutgrass)						
2,4-D	1 percent	----------	Oil	----------	Ponds; recommended rate	(232)
2,4-D, BE	----------	3 lb	Kerosene, 75 gal	Resistant	Lake tests, TVA	(147)
2,4-D, IPE	2 percent	8 lb	Water	Killed	Pond tests	(195)
2,4-D, Na salt	----------	3 lb	do	Resistant	Lake tests, TVA	(147)
2,4,5-T	2.5 percent	10 lb	Oil, 50 gal	Killed	Pond tests	(195)
	0.25 percent	4 lb	Oil	----------	Pond test; recommended rate	(195)
Silvex	1 percent	35.4 lb	Water	Excellent	Pond tests	(195)
TCA	----------	860 lb	Water	20 percent	----------	(195)
	----------	645 lb	do	80 percent	Following aromatic oils	(195)
	----------	285 lb	do	95 percent	Drained habitat, July spraying.	(224)
	----------	380 lb	do	100 percent	Drained habitat, July spraying, treated Apr. 25, plots covered with water.	(224)
Dalapon	----------	175 lb	Water	Excellent kill	Pond tests	(195)
	----------	85 lb	do	----------	Pond tests; recommended rate	(195)
	----------	80 lb. (each)	do	Failed to eradicate	Treated May 25 and July 19	(224)
	----------	192 lb	do	Incomplete	Drained habitat, July spraying.	(224)
	----------	20 lb	do	45 percent	Treated Apr. 25 or May 26, plots covered with water.	(224)
	----------	50 lb	do	50 percent	do	(224)
	----------	75 lb	do	95 percent	do	(224)
	----------	100 lb	do	96 percent	do	(224)
	----------	50 and 50 lb	do	92 percent	1st treatment, May 21, wet; 2d treatment, June 4, moist.	(225)
	----------	50 and 14 lb	do	90 percent	do	(225)
	----------	100 lb	do	20 percent	Treated May 21, surface water.	(225)
	----------	10 lb. (each)	Water, 8 gal. (each).	Stunted only	Treated June 13 and July 19, sprayed, checked in Oct., wet plots.	(99)
	----------	10 lb. (each)	do	80-percent top kill	Treated June 13 and Aug. 6, sprayed, checked in Oct., wet soil.	(99)

See footnotes at end of table, p. 121.

TABLE 11.—*Effects of certain aquatic herbicides on marginal weeds*—Continued

Zizaniopsis miliacea (Giant cutgrass)—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Dalapon—Continued		10 lb	Water, 8 gal	80 percent	Tidal area, 0–2 feet water, 1-season test.	(*99*)
		10 lb. (each)	Water, 8 gal. (each).	None	Treated June 13, July 9, and Aug. 25, 1957, and May 28, June 16, July 1, 1958, checked in Oct. 1958.	(*98*)
		10 lb. (each)	do	80 percent to none	5 applications in 1957, checked in Oct. 1957 and Oct. 1958.	(*98*)
		50 lb	Water	90–92 percent	Research trials, N.J	(*97*)
		100 lb	do	100 percent	Research trials, refuges	(*97*)
Dalapon+Tide		10 lb	30 oz. Tide+water, 100 gal.	80 percent, 1 year	Treated May 6 and Aug. 4, water depth 0–4 feet, Alazon Lake, Tex.	(*140*)
		15 lb	do	90 percent, 1 year	do	(*140*)
		20 lb	do	95 percent, 1 year	do	(*140*)
		10 lb	do	75 percent, 1 year	Sprayed July 1, water depth 0–1 foot, Highland Lake, Tex.	(*140*)
		20 lb	do	80 percent, 1 year	Sprayed July 1, water depth 0–4 feet, Tex.	(*140*)
		40 lb	do	100 percent, 1 year	Sprayed July 1, water depth 1–3 inches, Tex.	(*140*)
		22 lb	do	99 percent, 1 year	Sprayed May 29, drained plots, Highland Lake, Tex.	(*140*)
		28 lb	do	do	do	(*140*)
		47.5 lb	do	80 percent, 1 year	do	(*140*)
		20 lb	do	90 percent, 1 year	Sprayed June 27, water depth less than 10 inches, Tex.	(*140*)
Monuron		10 lb	Water	No kill	Drained habitat, July spraying, treated Apr. 25, plots covered with water.	(*224*)
		30 lb	do	do	do	(*224*)
		50 lb	do	do	do	(*224*)
		80 lb	do	do	do	(*224*)
		10 lb	do	Good	Treated May 25, plots covered with water.	(*224*)
		30 lb	do	do	do	(*224*)
		50 lb	do	100 percent	do	(*224*)
		80 lb	do	do	do	(*224*)
Diuron		600 lb		Not effective	Aquatic habitat	(*195*)
		600 lb		do	do	(*195*)
		600 lb	Water	Effective kill	Dry plots	(*195*)
MH		25 lb	Water	100 percent	Marsh tests, sprayed plots	(*224*)
		60 lb	do	90 percent	do	(*224*)
		120 lb	do	100 percent	do	(*224*)
Amitrole		5 to 50 lb	Water	Ineffective	Treated May 24, heavy rain 11 hours later.	(*225*)
		5 to 50 lb	do	Poor to 50 percent	Treated May 28, heavy rain 48 hours later.	(*225*)

Erbon		120 to 200 lb	Water	75–95 percent	Treated May 4, area flooded	(225)
AMS		215 lb	Water, 50 gal	Killed	Pond tests	(195)
		430 lb	Water + Vatsol OS.	100 percent	do	(195)
		100 lb	Water + detergent.	Effective	Sprayed	(215)
Chlorox		50 gal		Excellent kill	Ponds tests	(195)
		25 gal		Good kill	Dewatered pond area	(195)
		75 gal		do	Watered area, pond tests	(195)
Borascu		1,000 lb		Slight	Dewatered pond area	(195)
Sodium arsenite		100 lb	Water + detergent.	Effective	Sprayed	(215)
Sodium chlorate		430 lb	do	do	do	(215)
2,3,6 TBA		1.5 to 30 lb	Water	Ineffective	Plants treated in Apr. and May, underwater throughout test.	(101)
Polybor-chlorate		430 lb	Water	70 percent		(195)
		1,075 lb	do	90 percent		(195)
		645 lb	do		Recommended rate	(195)
Brush killer		100 lb		80 percent	Pond tests	(195)
		40 lb		95 percent	do	(195)

MISCELLANEOUS SPECIES

A—*Aeschynomene virginica*, curly indigo
B—*Caperonia castaneaefolia*, Mexican-weed
C—*Cyperus articulatus*, yellow sedge
D—*Sesbania macrocarpa*, indigoweed
E—*Sphenoclea zeylanica*, gooseweed

[Species indicated by letters in "Remarks" column]

2,4-D		1 lb	Water	Killed	Before flooding rice, B present	(200)
		.75 to 1 lb	do	do	Ricefield, D present	(200)
		1.5 lb	do	do	After 6 weeks flooding ricefield, A present.	(200)
		1.5 lb	do	do	Ricefield, C present	(200)
		1.5 lb	do	No kill	Ricefield, E present	(200)

[1] Except as indicated.
[2] AUBURN UNIVERSITY. DATA ON CHEMICAL WEED CONTROL IN PONDS. Ala. Agr. Expt. Sta., Farm Ponds Proj., Unpublished Ann. Rpts. 1946–61.
[3] Personal correspondence from T. W. Wright.

TABLE 12.—*Effects of certain aquatic herbicides on floating weeds*

Eichhornia crassipes (Water-hyacinth)

Herbicide	Concentration	Rate per acre	Carrier	Control or response	Remarks	Reference
2,4-D, amine salt		1 to 4 lb	Water, 2–150 gal		Lakes and streams; recommended rate.	(*211*)
	1.3 percent	8 lb	Water, 80 gal	Good		(*174*)
2,4-D		2 lb		90-percent kill		(*174*)
	0.07 percent	3 lb	Water	Killed in 3 weeks	(Carbowax 1500)	(*153*)
	0.1 percent	4 lb	do	do	do	(*153*)
	0.06 percent	2.5 lb	do	90-percent kill in 3 weeks.	do	(*153*)
2,4-D alkanolamine salt	0.5 percent	2 or more lb	Water, 43–70 gal	90–100 percent	Lake tests	(*155*)
2,4-D allyl	0.5 percent	2 or more lb	do	90–100 percent; 60 percent sank in 41 days.		(*155*)
2,4-D, diethanolamine		2 to 4 lb		35–73 percent	Triplicated tests, Fla	(*211*)
2,4-D acid, emulsifier		2 to 4 lb		57–88 percent	do	(*211*)
2,4-D, acetamide		2 to 4 lb		43–68 percent	do	(*211*)
2,4-D acid, emulsifier		0.5 lb		22 percent	do	(*211*)
2,4-D, acetamide		0.5 lb		25 percent	do	(*211*)
2,4-D, diethanolamine		1 lb		35 percent	do	(*211*)
2,4-D acid, emulsifier		1 lb		36 percent	do	(*211*)
2,4-D, acetamide		1 lb		33 percent	do	(*211*)
2,4-D, acid	5 p.p.m		Acetone or ethanol.	100 percent	Plastic-pool tests, Ala	(*211*)
2,4-D		1 to 1.5 lb	Water	95-percent initial kill; regrowth in 1 month.	Sugarcane field	(*115*)
		1.5 lb	do	Killed	Ricefield, La	(*200*)
	0.5 percent				Ponds; recommended rate	(*232*)
		8 lb		Eradicated	Resprayed once to complete	(*156*)
2,4-D, salt or ester		1 lb	Water	Good	Streams and canals, Fla	(*221*)
2,4-D, BEE		2 to 4 lb		58–88 percent	Triplicated tests, Fla	(*211*)
2,4-D, invert, BEE		2 to 4 lb		23–38 percent	do	(*211*)
2,4-D, BEE		0.5 lb		40 percent	do	(*211*)
2,4-D, invert, BEE		0.5 lb		15 percent	do	(*211*)
2,4-D, BEE		1 lb		35 percent	do	(*211*)
2,4-D, invert, BEE		1 lb		23 percent	do	(*211*)
2,4-D, BE	0.5 percent	2 or more lb	Water, 43–70 gal	90–100 percent; 60 percent sank in 41 days.	Lake tests	(*155*)
2,4-D, IPE		18 lb		95 percent	Irrigation channels	(*180*)
		.5 lb		Good	Aerial application	(*167*)
		.75 lb	Water	do	Air boat spraying	(*167*)
		2 or more lb	Water, 43–70 gal	90–100 percent; 60 percent sank in 41 days.	Lake tests	(*155*)
		36.1 lb		100 percent	Greenhouse tests, checked 6 weeks after 2d application, ⅔ applied at 1st application.	(*181*)
		33 lb		do	do	(*181*)
		28.7 lb		do	do	(*181*)

2, 4-D, IPE—Continued	----------	28.3 lb	----------	100 percent	do	(181)
	----------	26.9 lb	----------	do	do	(181)
	----------	21.6 lb	----------	90 percent	do	(181)
	----------	18.2 lb	----------	95 percent	do	(181)
	----------	11.5 lb	----------	85 percent	do	(181)
2,4-D, IPE+Na TCA	1.2 percent + 10 percent.	----------	Water	100 percent; all plants sank in 41 days.	----------	(155)
Silvex	2 p.p.m	----------	----------	100 percent; plants killed in 21 days.	Pond tests	(1)
	5 p.p.m	----------	----------	100 percent; plants killed in 14 days.	do	(1)
Silvex, acid	5 p.p.m	----------	Acetone or ethanol.	100 percent	Plastic-pool tests, Ala	(211)
Silvex, PGBEE	----------	1.5 lb	----------	80 percent	Triplicated tests, Ga	(235)
	----------	2 lb	----------	90 percent	do	(235)
Monuron	10 to 19 p.p.m	----------	----------	Killed	Dewatered area	(180)
Amitrole+NH_4CNS	----------	0.5 lb	----------	57 percent	Triplicated tests, Fla	(211)
	----------	2 lb	----------	93 percent	do	(211)
	----------	1 lb	----------	82 percent	do	(211)
Fenac	----------	1 lb	----------	12 percent	Triplicated tests, Fla	(211)
	----------	2 to 4 lb	----------	48–83 percent	do	(211)
Lemna spp. (Duckweeds)						
2,4-D	1 percent	----------	Oil	----------	Ponds; recommended rate	(232)
2,4-D, BE	0.5 percent	----------	Water	No effect	Pond tests	(104)
	0.5 percent	----------	Diesel fuel	Partial kill	Pond tests, hand sprayer	(1)
2,4-D, IPE	0.5 percent	4 to 6 lb	Diesel fuel	Partial kill	Pond tests, hand sprayer	(1)
Silvex	10 p.p.m	----------	----------	Partial	10-day exposure in jar	(110)
Silvex, PGBEE	2 p.p.m	----------	----------	None	Flowed into pond, Ga	(235)
DCB	4 to 6 p.p.m	15 gal	----------	Good kill	----------	(124)
Erbon	2.5 p.p.m	----------	----------	Browned, no kill	Pond tests, 21 days	(251)
	5 p.p.m	----------	----------	Good	10-day exposure in jar	(110)
	10 p.p.m	----------	----------	100 percent	do	(110)
AMS	----------	150 lb	Water + Vatsol OS.	Killed plants sprayed	Pond tests	(103)
Copper sulfate	1 p.p.m	----------	----------	No kill	Pond tests, N.Y	(133)
Sodium arsenite	5 p.p.m	----------	----------	None	Pond tests	(170)
	1.5 p.p.m	----------	----------	100 percent	Flowed into pond, Ga	(235)
	3 p.p.m	----------	----------	do	do	(235)
	6 p.p.m	----------	----------	do	do	(235)
Delrad	1 p.p.m	----------	----------	No kill	Pond tests, N.Y	(133)
Oktone	0.7 percent	20 gal	Diesel fuel	Good	Surface spray on ponds	(175)
	----------	20 gal	do	do	do	(1)
#2 diesel fuel	----------	50 gal	----------	100 percent	Pond tests, Ga	(235)
	----------	75 gal	----------	do	do	(235)
	----------	90 gal	----------	do	do	(235)
	----------	60 gal	----------	75 percent; 100-percent regrowth.	do	(235)
	----------	50 gal	----------	98 percent; 2-percent regrowth.	do	(235)

See footnote at end of table, p. 124.

TABLE 12.—*Effects of certain aquatic herbicides on floating weeds*—Continued

Herbicide	Concentration	Rate per acre [1]	Carrier	Control or response	Remarks	Reference
Lemna minor (Duckweed)						
2,4-D		8 lb	Water, 200 gal	Satisfactory	Research trials, spray, N.Y	(*97*)
	100 p.p.m			Ineffective	Greenhouse tests, 20 days	(*198*)
2,4-D+2,4,5-T		4 lb	Water, 80 gal	100 percent	Spray application, light infestation, pond tests, Ga.	(*236*)
2,4,5-T, amine		4 lb	do	do	do	(*236*)
Silvex	1 p.p.m			None; browned within 48 hours, recovered.	Ponds, N.J	(*252*)
	2 p.p.m			do	do	(*252*)
	2 p.p.m			100 percent; killed in 28 days.	Pond tests	(1)
	5 p.p.m			100 percent; killed in 21 days, no regrowth within 6 months.	do	(1)
		4 to 16 lb	Water	Unsatisfactory	Research trials, spray, N.J	(*97*)
		4 to 16 lb	Fuel oil	Satisfactory	do	(*97*)
Erbon	2 p.p.m			Unsatisfactory	Research trials, N.J	(*97*)
Chlorox'40'		430 lb		Satisfactory	Research trials, spray, N.J	(*97*)
Sodium arsenite	4 p.p.m		Water	100 percent	Gravity flow into water, pond tests, Ga.	(*236*)
	2 p.p.m		do	do	do	(*236*)
	1 p.p.m		do	do	Sprayed over plants, pond tests, Ga.	(*236*)
	100 p.p.m			do	Greenhouse tests, 14 days	(*198*)
Ammonium thiocyanate	100 p.p.m			Resistant	Greenhouse tests, 28 days	(*198*)
#2 stove oil		Spray till wet		100 percent	Do not exceed 20 gal. per acre, retreat as necessary.	(*211*)
#2 diesel fuel		215 gal		Satisfactory	Research trials, spray, N.J	(*97*)
DB		215 lb	Water	Unsatisfactory	do	(*97*)
Diquat		2 lb		100 percent; rapid kill	Fla	(*211*)
Salvinia rotundifolia (Waterfern)						
2,4,5-T, invert, PGBEE		4.5 lb		90–100 percent; practically eradicated.	5-acre pond, Fla	(*211*)
		18 lb		do	¼-acre pond, Fla	(*211*)
Diquat		2 lb		100 percent	Pond tests, Fla	(*211*)

[1] AUBURN UNIVERSITY. DATA ON CHEMICAL WEED CONTROL IN PONDS. Ala. Agr. Expt. Sta., Farm Ponds Proj., Unpublished Ann. Rpts. 1946–61.

TABLE 13.—*Effects of certain aquatic herbicides on miscellaneous weeds*

Herbicide	Concentration	Rate per acre	Carrier	Control	Remarks	Reference
Conyza sp.						
2,4,5-T	0. 25 percent		Water		Ponds in Israel; recommended rate.	(*201*)
Inula sp.						
2,4,-D, amine	0. 5 percent	8 to 16 lb	Water		Ponds in Israel; recommended rate.	(*201*)
Rubus spp.						
2,4,5-T	0. 6–0. 7 percent.		Water		Ponds in Israel, 2–3 applications; recommended rate.	(*201*)

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