Table 1. Response of common aquatic weeds to herbicides

Aquatic Herbicides

Aquatic group and weed	copper complexes copper sulfate	2,4-D	diquat	endothall	fluridone	glyphosate
Algae						
planktonic	E	P	P	P	P	P
filamentous	E	P	E	G[1]	P	P
chara	E	P	G	G[1]	P	P
nitella	E	P	G	G[1]	P	P
Floating Weeds						
bladderwort	P	G[2]	E			E
duckweeds	P	G[3]	G	P	E	
water hyacinth	P	E	E		P	G
watermeal	P	P	P-F		F-G	
Emersed						
alders	P	E	F	P	P	E
alligatorweed	P	F	P	P	G	E
American lotus	P	E	P	P	F	G
arrowhead	P	E	G	G		E
buttonbush	P	E	F	P	P	G
cattails	P	G	G	P	F	E
fragrant and white waterlily	P	E	P		E	E
frogbit	P	E	E			
maidencane	P	P	F		F	E
pickerelweed	P	G	G		P	F
pond edge annuals	P		G	P	F	E
sedges and rushes	P	F	F		P	G
slender spikerush	P		G		G	P
smartweed	P	E	F		F	E
spatterdock	P	E	P		E	G-E
southern watergrass	P	P			G	
torpedograss	P	P	P		F	G
watershield	P	E	P	P	G	G
water pennywort	P	G	G		P	G
water primrose	P	E	F	P	F	E
willows	P	E	F		P	E
Submersed Weeds						
broadleaf water-milfoil	P		E	E	E	P
coontail	P	G	E	E	E	P
egeria	P	P	G	F	E	P
elodea	P		E	F	E	P
eurasian water-milfoil	P	E	E	E	E	P
fanwort	P	F	G	E	E	P
hydrilla	F[4]	P	G	G	E	P
naiads	P	F	E	E	E	P
parrotfeather	P	E	E	E		F
pondweeds (Potamogeton)	P	P	G	E	E	P

E= excellent control; G=good control; F=fair control; P=poor control
[1]Hydrothol formulations only.
[2]Granular 2,4-D formulations
[3]Liquid ester formulations only
[4]Copper complexes

Aquatic Herbicides

The herbicides discussed on this page are labeled for use in commercial fish production ponds. The herbicide label should be read and fully understood prior to pond application.

Copper sulfate
(Various trade names)

Copper sulfate is primarily used to control algae. It is a contact herbicide and quickly kills sensitive algal species. Copper can interfere with gill function and if improperly used can be toxic to fish. The majority of fish kills due to copper sulfate treatment are primarily caused by a massive algae kill and subsequent oxygen depletion problems.

The effectiveness and safety of copper sulfate is determined by alkalinity and water temperature. In waters with an alkalinity ≤ 50 ppm, the rate of copper sulfate needed to control algae can be toxic to fish. Treatment at water alkalinities of ≤ 20 ppm is extremely risky. In high alkalinity (≥ 250 ppm) waters, copper sulfate quickly precipitates out and is not effective for algae control. The toxicity of copper sulfate to fish increases as water temperature increases. Avoid copper sulfate applications during hot summer months.

Chelated Copper
(Komeen, K-Tea, others)

Copper that is held in an organic complex is known as chelated copper. Chelated copper formulations do not readily precipitate in high alkalinity waters, but stay in solution and remain active longer than copper sulfate. Chelated copper is less corrosive to application equipment than copper sulfate. Due to its enhanced solubility, chelated copper is generally used at rates slightly lower than copper sulfate. Chelated copper formulations are slightly less toxic to fish than copper sulfate. However, in waters with low alkalinity (≤ 20 ppm), or in water with an alkalinity of ≤ 50 ppm that contains trout, chelated copper use is extremely risky, particularly during the hot summer months.

Diquat
(Reward)

Diquat is a contact herbicide that can be used as a "pour-in" treatment for submersed weed and filamentous algae control or as a foliar application for duckweed (*Lemna minor* and *Spirodela polyrhiza)* control. An approved nonionic surfactant is required when diquat is used as a foliar application. Diquat is tightly bound to clay micelles and is not effective for weed control in muddy water. Diquat quickly kills plants and should be used as a partial pond treatment for dense vegetation.

Endothall
(Aquathol, Hydrothol)

Two salts of endothall are used for aquatic weed control. A dipotassium salt is available as a granular or liquid formulation by the trade name of Aquathol. Hydrothol is available as a liquid or granular formulation and is a mono-(N,N-dimethyl-alkylamine) salt of endothall. Aquathol and Hydrothol vary considerably in their safety to fish and weed control spectrum. Hydrothol is more toxic to fish so consequently, Aquathol is generally used in commercial ponds. Hydrothol controls algae (filamentous and stoneworts) and many submersed weeds. Aquathol controls many submersed weeds but is not effective for algae control. Both Aquathol and Hydrothol are contact herbicides and may be used on a spot or partial pond treatment basis.

Fluridone
(Sonar)

Fluridone controls most submersed and emersed weeds and is available as a liquid or pelleted formulation. Liquid formulations may also be used to control duckweed. Fluridone is a translocated herbicide that slowly kills plants over a 30- to 90-day period. The slow action of fluridone generally prevents the occurrence of weed decomposition-induced oxygen problems. Fluridone is not effective as a spot treatment. The entire pond must be treated to control the target weed species.

Glyphosate
(Rodeo, Pondmaster)

Glyphosate is a foliar applied, translocated herbicide that is used to control most shoreline vegetation and several emersed weeds such as spatterdock *(Nuphar luteum)* and alligatorweed *(Alternanthera philoxeroides)*. Glyphosate translocates from the treated foliage to underground storage organs such as rhizomes. Applications at the flowering or fruiting stage of perennial plants are generally more effective than earlier applications due to better translocation to underground plant parts. An approved nonionic surfactant should be used with glyphosate (Rodeo formulations only). Rainfall occurring within 6 hours of application will reduce the effectiveness of glyphosate.

2,4-D
(Various trade names)

2,4-D is a translocated herbicide that is available as a granular or liquid formulation. Granular 2,4-D controls submersed weeds such as coontail *(Ceratophyllum demersum)* and emersed weeds such as water lily *(Nymphaea spp.)*. Liquid formulations of 2,4-D are used to control floating weeds such as water hyacinth *(Eichhornia crassipes)* and several emersed weeds. 2,4-D is available as an ester or amine formulation which is slightly better for aquatic applications. However, the liquid ester formulation is more toxic to fish than the amine. The granular ester form is safer to use in aquatic applications. There are numerous uses for 2,4-D, but only those labeled for aquaculture use are legal.

The information and suggestions included in this publication reflect the opinions of Extension fisheries specialists based on field tests and use experience. Our management suggestions are a product of research and are believed to be reliable. However, it is impossible to eliminate all risk. Conditions or circumstances which are unforeseen or unexpected may lead to less than satisfactory results even when those suggestions are used. Neither the Cooperative Extension Service nor the Southern Regional Aquaculture Center assumes responsibility for such occurrences. Such risk shall be assumed by the USER of this publication.

Suggested herbicides must be registered and labeled for use by the Environmental Protection Agency and the Department of Agriculture. The status of herbicide label clearances is subject to change and may have changed since this publication was printed. County Extension agents and appropriate specialists are advised of changes as they occur.

The USER is always responsible for the effects of herbicide residues on livestock and crops, as well as problems that could arise from drift or movement of the herbicide from his/ her property to that of others. Always read and follow carefully the instructions on the container label.

The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Southern Regional Aquaculture Center or the Cooperative Extension Service is implied.

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