

AQUATIC ENVIRONMENTS

FISHERY CHEMICALS — (PARASITES, PISCICIDES AND OTHER TREATMENTS)¹

Updated by Gary J. Burtle, Extension Aquaculture and Fisheries

	CHEMICAL	APPLICATION RATE	CATEGORY OF USE ¹	COMMENTS
A. Fish Parasites	Formalin	25 ppm in ponds (7.5 gals./acre-foot)	F	Use in warm weather may cause oxygen depletion. Provide aeration during treatment to prevent low oxygen. Use with extreme caution when dissolved oxygen is 5 ppm or lower.
		125-250 ppm (1-2 pints per 1000 gal. in tanks for one hour)		In tanks, if stress is excessive, flush with fresh water. Use lower rate in water above 70°F.
B. Piscicides	Antimycin	1-10 ppb active ingredient (0.4-4.3 fl. oz./acre-foot)	N	Treatment rate dependent on water temperature and pH.
	Rotenone (Restricted)	1-5 ppm active ingredient (2.7-13.6 lb./acre foot)	N	Do not use in waters colder than 65°F.
C. Miscellaneous Aquatic Treatment	MS-222 (Anesthetic)	15-66 ppm active ingredient for 6-48 hours for sedation; 50-330 ppm active ingredient for 1-40 minutes for anesthesia	F	21-day preslaughter withdrawal period.
	Romet 30 (Bactericide) Ormetropin + Sulfadimethoxine	2.3 g. active ingredient/100 lb. fish per day for 5 days in feed	F	3-day preslaughter withdrawal period for catfish, do not use on trout within 6 weeks of marketing or release as stocker fish.
	Terramycin (Bactericide)	2.5-3.75 g. active ingredient/100 lb. fish per day for 10 days in feed	F	21-day preslaughter withdrawal period.
	Calcium hypochlorite (Disinfectant & sterilant)	10 ppm available chlorine (38.8 lb./acre-foot)	F	Kills all fish and some parasites.
	Hydrated Lime (Disinfectant & sterilant)	1,338 lb./acre burnt lime	F	Drained pond treatment.
		1,784 lb./acre slaked lime	F	Drained pond treatment.
	Potassium permanganate (oxidizing agent)* (Cairox)	2 ppm (5.4 lb./acre-foot)	F	Drinking water treatment. Treatment may have to be repeated within 24 hours to be effective.**
Salt (sodium chloride) (hauling aid)	0.5-3% (83 to 250 lb./1000 gal.) Dip for 30 minutes to 2 hours; for a continuous bath 1 to 2 lb./100 gal. Pond treatments of 100 ppm to 150 ppm indefinitely for osmotic enhancement.	F		

¹ Adapted from R.A. Schnick, F.P. Meyer and D.L. Gray. 1986. *A Guide to Approved Chemicals in Fish Production and Fishery Resource Management*. University of Arkansas Cooperative Extension Service and U.S. Fish and Wildlife Service.

² F - Approved for use on fish intended for human or animal consumption. N - Not approved for use on fish intended for human or animal consumption.

*Zebra mussels, biofilm, and other biofoulers such as algae and microorganisms.

**Limit residual to less than 1 ppm. Taste, odor, zebra mussel, hydrogen sulfide, and organic pollutant oxidation control.

AQUATIC WEED CONTROL

Updated by Gary J. Burtle, Extension Aquaculture and Fisheries

USE STAGE/HERBICIDE	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
	AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	
Algae copper sulfate (Triangle copper-sulfate) 99% Granule 99% Snow 99% Crystal, Others	2.7-5.4 lbs.* 2.7-5.4 lbs.* 2.7-5.4 lbs.* 2.7-5.4 lbs.*	1.0-2.0 ppm* 1.0-2.0 ppm* 1.0-2.0 ppm* 1.0-2.0 ppm*	Apply at early stages in algae development (usually April or May), repeat as needed. Read and observe all label cautions and instructions. Copper algaecides may be toxic to fish at high rates. Use the low rate in acid waters and the high rate in alkaline waters. The rates suggested should not be toxic except through oxygen depletion. Under heavy infestations, treat only 1/4 to 1/3 the water body at any one time to avoid fish suffocation caused by oxygen depletion. Copper containing products may be used for spot treatments of algae. Copper sulfate, copper complexes and diquat may also be used in commercial fish production ponds.
copper sulfate - acidified liquid (Earhtec or Agritech) 5.0% as copper, 9.9 lb/gal	1.0 to 40.0 pt*	0.06 to 2.5 lbs.	Dosage is variable according to algae species, pH and water temperature.
copper complex (Cutrine-Plus) 0.9 lbs./gal. (Cutrine-Plus G) 3.7% Granule (K-Tea) 0.8 lbs./gal.	0.6-1.2 gal.* 60.0 lbs. 0.7-1.4 gal.*	0.2-0.4 ppm* --- 0.2-0.4 ppm*	Several formulations are marketed, so check labels for use restrictions.
diquat (Reward) 2 lbs./gal. (Weed-Trine D) 0.4 lbs./gal.	1.0-2.0 gal. 3.4-10.2 gal.*	2.0-4.0 lbs. 0.5-1.5 ppm*	Diquat is effective for filamentous algae control. Apply Diquat as recommended in SUBMERSED WEEDS section. Use 1.0 gal. Reward per surface acre in water with an average depth of 2.0 feet. The higher rate may be used in water with an average depth greater than 2.0 feet. Repeat applications will be necessary.
endothall (Hydrothol 191) granular, 11.2% (Hydrothol 191) liquid, 2 lbs./gal.	3 to 81 lbs./A-ft 0.6 to 1.8 pts./A-ft	0.05 to 1.5 ppm 0.05 to 1.5 ppm	Hydrothol formulations are toxic to fish and should be used only on sections by a commercial applicator at rates below 0.3 ppm unless fish kills are not objectionable.
Flumioxazin (Clipper)	6.0 to 12.0 oz/ surface-A	0.36 to 0.71 lb	Disperse in 50 to 100 gal/acre and buffer pH 5-7.
Aquashade	1.0 gal./4 acre ft.	1.0 ppm	Aquashade is a non-toxic blue dye that controls filamentous algae by blocking light penetration for up to six weeks after application. May be used in lakes, ponds, ornamental ponds and fountains and commercial fish production ponds that have little or no outflow. Apply one gallon of Aquashade per one acre of water that averages 4.0 feet deep in the early spring before weed growth begins, or apply when weeds may be seen on bottom of pond. Additional applications will be necessary through the year to maintain an acceptable level of dye in the water. May be used at any time of year, but is less effective when weed growth is near the surface. Do not apply to water that will be used for human consumption. Water may be used for swimming after complete dispersal of the dye in water. Aquashade is non-toxic to livestock.
sodium carbonate peroxyhydrate (Green Clean Pro) 50% Granular (PAK-27) 85% granular (Green Clean Liquid, 27)	8-90 lbs/A-ft 4-45 lbs/A-ft 8-16 lbs/A-ft 6.8-13.6 lbs/A-ft 1.2-12 gal/A		For use in ponds that are not for commercial food fish production. Elevated pH may occur. Mix with 50 to 100 gal. water per surface acre and spray evenly over the infested area. Use higher rates for filamentous algae. Repeat treatment for dense infestations. Not for food fish use. May elevate pH up to 1.0 point, especially if applied in the afternoon.

*Indicates rate per acre foot of water. All other formulation rates are based on amount per surface area.

AQUATIC WEED CONTROL (continued)

USE STAGE/HERBICIDE	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
	AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	
Floating Weeds diquat (Reward) 2 lbs./gal. (Weedtrine-D) 0.4 lbs./gal. fluridone (Sonar AS)	1.0 gal.	2.0 lbs.	Spray to wet exposed plants with 50-150 gallons of water per acre plus 1.0 pt. of nonionic surfactant per 100 gal. of spray mix. Do not apply to muddy water. Labeled also for commercial fish production ponds. Consider tank mixes with chelated copper formulations for resistant duckweeds. Apply Sonar AS as a surface application to duckweed at labeled rates. Apply only once per year when duckweed is present. Apply Sonar to bladderwort as suggested in the EMERSED WEEDS section. See REMARKS AND PRECAUTIONS for Sonar as listed in the EMERSED WEEDS AND SUBMERSED WEEDS sections. 150 ppb for watermeal.
	5.0 gal.	2.0 lbs.	
	0.25 to 2.0 qt.	0.25 to 2.0 lbs.	
Floating Weeds 2,4-D (Hardball) 1.74 lbs./gal. imazapyr (Habitat) 2 lbs./gal. carfentrazone (Stingray) 1.9 lbs./gal.	2.25 gal.	3.9 lbs.	Controls water hyacinth. Do not apply to open water. Apply only to dense stands. Treat 1/3 to 1/2 of the water body to avoid oxygen depletion problems.
	See label.		Use of spreader-stickers will improve results. Ensure complete coverage by applying with 100 gallons water per acre.
	3.4-13.5 ozs.	0.025-0.2 lbs.	Use a non-ionic surfactant and 100 gallons of dilution water per surface area. 80% of foliage should be exposed to treatment. Use tank mixes with 2,4-D, glyphosate or diaquat products for better control at the lower rates of application
Floating Weeds Flumioxazin (Clipper)	6.0 to 12.0 oz/ surface-A	0.36 to 0.71 lb	Disperse in 50 to 100 gal/acre and buffer to pH 5-7.
Emersed Weeds 2,4-D (Aqua-Kleen) 19G (2,4-D Granules) 19G (Navigate granules) 19% DP Acid equivalent (Hardball) 1.74 lbs./gal. glyphosate (Rodeo) 5.4 lbs./gal. (Aqueat) (Eagre) fluridone (Sonar AS) (Sonar SRP) imazapyr (Habitat) 2 lbs./gal. carfentrazone (Stingray) 1.9 lbs./gal. triclopyr (Renovate 3) 3 lbs./gal.	100 to 200 lbs. 100 to 200 lbs. 100 to 200 lbs.	19-38 lbs. 19-38 lbs. 27.6 to 55.2 lbs.	Spray to wet foliage or spread granules uniformly in infested area in spring or early summer. Read the label for specific weeds controlled and special precautions. Do not apply to more than 1/2 the pond in any one month. Do not apply to waters used for irrigation, agricultural sprays, watering dairy animals, or domestic waters. This group of products is also labeled for commercial fish production ponds. Applications made after September may be less effective depending on water temperatures and weed growth.
	2.25 gal.	3-9 lbs.	
	See label.		Apply after drawdown or when water is present. Allow 7 or more days after drawdown treatment before reintroduction of water (apply within one day after drawdown). Add 2.0 qts. of a manufacturer approved surfactant per 100 gal. of spray solution. Rodeo may be used in commercial fish production ponds.
	Rates vary Rates vary	Rates vary Rates vary	Controls several emersed weeds. Apply Sonar AS as a surface spray, or near the bottom with weighted trailing hoses or meter into pumping system. Uniformly broadcast the SRP formulation. Trees or shrubs growing in water treated with Sonar may be injured. Thirty to 90 days are required before desired weed control is achieved. Use Sonar SRP (slow release pellet) in irrigation or drainage canals with slow moving water. Not recommended for spot treatment. Labeled also for commercial fish production ponds.
	See label.		Use of spreader-stickers will improve results. Ensure complete coverage by applying with 100 gallons water per acre.
	3.4-13.5 ozs.	0.025-0.2 lbs.	Use a non-ionic surfactant and 100 gallons of dilution water per surface area. 80% of foliage should be exposed to treatment. Use tank mixes with 2,4-D, glyphosate or diaquat products for better control at the lower rates of application
	0.25 to 3 gal.	0.75 to 9 lbs.	Do not spray open water. Use non-ionic surfactant for foliar application according to surfactant label. Not for water intended for irrigation. Avoid overspray to open water.

*Indicates rate per acre foot of water. All other formulation rates are based on amount per surface area.

AQUATIC WEED CONTROL (continued)

USE STAGE/HERBICIDE	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
	AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	
Submersed Weeds diquat (Reward) 2 lbs./gal. (Weedtrine-D) 0.4 lbs./gal. 2,4-D granular (Aquakleen) 19G (2,4-D Granules) 19G (Hardball) 1.74 lbs./gal.	1.0-2.0 gals.	2.0-4.0 lbs.	Apply in early season where submersed growth has not reached the surface by pouring directly from the container into the water while moving slowly over the water surface in a boat. Distribute in strips 40 feet apart. In late season or where submersed weed growth has reached the surface, use the high rate indicated on the label for the weeds present. Also labeled for commercial fish production ponds. Do not apply to muddy water. See comments for granular formulations in "Emersed Weeds" section. Effective on parrotfeather, coontail and Eurasian watermilfoil. Also labeled for commercial fish production ponds.
	5.0-10.0 gals.	2.0-4.0 lbs.	
	100.0-200.0 lbs. 2.5-10 gal./A	19-38 lbs. 4.3-17.0 lbs./A	
endothall (Aquathol Granular) 10.1% (Aquathol Super K Granular) 63.0% (Aquathol K) 4.2 lbs./gal. (Hydrothol Granular) 5G (Hydrothol 191) 2 lbs./gal.	13.0-81.0 lbs.*	0.5-3.0 ppm*	Aquathol and Aquathol K are contact killers and must be applied as early as possible after weeds are present. Water temperature should be a minimum of 65° F. Water containing heavy weed growth should be treated in sections 5-7 days apart. Apply on a calm day. Hydrothol formulations are toxic to fish and should be used only on sections by a commercial applicator at rates below 0.3 ppm unless fish kill is not objectionable. Hydrothol formulations are not recommended for commercial fish production ponds. Aquathol formulations are also labeled for commercial fish production ponds. Apply Aquathol Super K evenly over the treatment area and as early as possible after weed growth is observed.
	0.3-1.9 gal.*	0.5-3.0 ppm*	
	3.0-27.0 lbs.*	0.05-0.5 ppm*	
	0.6 pts.-0.7 gal.	*0.05-0.5 ppm*	
Submersed Weeds Aquashade fluridone (Sonar AS) (Sonar SRP)	1.0 gal./4 acre ft.	1.0 ppm	Aquashade is a non-toxic dye that controls several submersed weeds, such as naiads, by blocking light penetration for up to six weeks after application. May be used in lakes, ponds, ornamental ponds and fountains and commercial fish production ponds that have little or no outflow. Apply one gallon of Aquashade per one acre of water that averages 4.0 feet deep in the early spring before weed growth begins, or apply when weeds are seen on bottom of pond. Additional applications will be necessary through the year to maintain an acceptable level of dye in the water. May be used at any time of year, but is less effective when weed growth is near the surface. Do not apply to water that will be used for human consumption. Water may be used for swimming after complete dispersal of the dye in water. Aquashade is non-toxic to livestock. Apply fluridone to control coontail, common elodea, egeria, hydrilla, naiad, pondweeds, and watermilfoils. See directions in "Emersed Weeds" section. Trees or shrubs growing in water or having roots growing in water treated with Sonar may be injured. Thirty to 90 days will be required before desired weed control is achieved. Not recommended for spot treatment. Also labeled for commercial fish production ponds.
	Rates vary Rates vary	Rates vary Rates vary	
Submerged Weeds Flumioxazin (Clipper)	0.1 to 0.4 PPM	Not more than 14.8 pounds per surface acre.	Disperse in 50 to 100 gal/acre and buffer to pH 5-7.
Floating plants Penoxsulam (Galleon SC) Imazamox (Clearcast)	2.0-5.6 oz	0.031-0.087 lb	Do not use if pond is used to irrigate food crops unless analyses show less than 1 ppb residue. Do not use in successive years.
	32-64 oz	0.24-0.5 lb	Spot spray foliage with 0.25 to 5% solutions in water with a surfactant.
Emersed weeds Penoxsulam (Galleon SC) Imazamox (Clearcast)	2.0-5.6 oz	0.031-0.087 lb	Do not use if pond is used to irrigate food crops unless analyses show less than 1 ppb residue. Do not use in successive years.
	32-64 oz	0.24-0.5 lb	Spot spray foliage with 0.25 to 5% solutions in water with a surfactant.
Drawdown application Penoxsulam (Galleon SC) Imazamox (Clearcast)	5.6-11.2 oz	0.087-0.175 lb	Mix with up to 100 gpa water and a surfactant for post- or pre-emergence use
	64 oz	0.5 lb	Wait two weeks before re-flooding the pond.

RESPONSE OF COMMON AQUATIC WEEDS TO HERBICIDES¹

Aquatic Group and Weed	copper complexes, copper sulfate	2,4-D (various)	diquat (Reward)	endothall (Aquathol K) (Aquathol G) (Hydrothol G) (Hydrothol 191)	fluridone (Sonar)	glyphosate (Rodeo) (Pondmaster)	carfentrazone	triclopyr	imazapyr
Algae									
planktonic	E	P	P		P	P	NR	NR	NR
filamentous	E	P	E	G ²	P	P	NR	NR	NR
chara	E	P	G	G ²	P	P	NR	NR	NR
nitella	E	P	G	G ²	P	P	NR	NR	NR
Floating Weeds									
bladderwort	P	G ³	E		E		-	P	NR
duckweeds	P	P	G ⁵	P	E	P	G	P E	G
water hyacinth	P	E	E		P	F	G	NR	G
watermeal	P	P	P ⁵		G	P	P		NR
Emersed									
alders	P	E	F	P	P	E	-	-	-
alligatorweed	P	F	P	P	G	E	F	G	G
American lotus	P	E	P	P	F	G	-	G	G
arrowhead	P	E	G	G		E	-	-	-
buttonbush	P	E	F	P	P	G	-	-	-
cattails	P	G	G	P	F	E	-	F	E
fragrant & white waterlily	P	E	P	P	E	E	-	G	E
frogbit	P	E	E						
maidencane	P	P	F		F	E	-	-	-
pickerelweed	P	G	G		P	F	-	NR	E
pond edge annuals	P		G	P	F	E	-	-	E
sedges/rushes	P	F	F		P	G	-	NR	G
slender spikerush	P		G ⁵		G	P	-	NR	-
smartweed	P	E	F		F	E	-	E F	E
spatterdock	P	E	P		E	G-E	-	-	E
So. watergrass	P	P			G	E	-	NR	-
torpedograss	P	P	P		F	G	-	P	E
watershield	P	E	P	P	G	G	-	-	P
water pennywort	P	G	G		P	G	-	G	-
water primrose	P	E	F	P	F	E	F	-	E
willows	P	E	F		P	E	-	-	-
Submersed Weeds									
broadleaf watermilfoil	P		E	E	E	P		E	NR
coontail	P	G	E	E	E	P	-	G	NR
egeria	P	P	F	F	E	P	-	NR	NR NR
elodea			E	F	E	P	-	NR	
eurasian water-milfoil	P	E	E	E	E	P		E	NR
fanwort	P	F	G	E	E	P	G	NR	NR
hydrilla	F ⁴	P	G	G	E	P	-	NR	NR
naiads	P	F	E	E	E	P	-	NR	NR
parrotfeather	P	E	E	E	F	F	-	E	NR
pondweeds (Potamogeton)	F	E	E	E	E	NR	-	E	NR
	P	P	G	E	E	P	- NR	NR	

¹ E = excellent control (90 to 100%); G = good control (80 to 89%); F = fair control (70 to 79%), P = poor control (<70%). A blank space indicates weed response is not known.

² Hydrothol formulations only.

³ Granular 2,4-D formulations.

⁴ Copper complexes only.

⁵ Cutrine Plus: Reward, 3:2 tank mix will improve response.

NR - Not recommended

- Insufficient data

Flumioxazin, Imazamox, and Penoxsulam have been recently labeled for use on floating, emergent, and submersed aquatic plants, but read labels for identities of specific plants controlled or partially controlled.

AQUATIC WEED CONTROL USE RESTRICTIONS¹

(Number of days after treatment before use)

Updated by Gary J. Burtle, Extension Aquaculture and Fisheries

(Common Name) Trade Name	Company	Conc. PPM	HUMAN		
			Drinking	Swimming	Fish Consumption
copper sulfate ²					
Copper Sulfate G	Tenn. Chem.	-	0	0	0
Copper Sulfate Snow	Tenn. Chem.	-	0	0	0
Copper Sulfate Crystal	Tenn. Chem.	-	0	0	0
Triangle Copper Sulfate	Triangle	-	0	0	0
(copper complexes)					
Cutrine-Plus	Applied	-	0	0	0
Cutrine-Plus G	Biochemists	-			
K-Tea	Griffin	-			
AquaCure	PBI Gordon	-			
(2,4-D)					
Aquakleen	Rhone-Poulenc	-	NL	0	0
2,4-D Granules	Riverdale	-	NL		
Hardball	Helena	-	NL		
(diquat)					
Reward ⁵	Zeneca	-	1-3	0	0
(endothall)					
Aquathol G	Atochem	0.5	7	1	3
Aquathol K		1.0-3.0	7	1	3
			14		3
Hydrothol 191 & Hydrothol 191G	Atochem	< 0.3	7	*	3
		0.5	14	*	3
(fluridone ³)					
Sonar AS	DowElanco	-	0	0	0
Sonar SRP	DowElanco	-	0	0	0
(glyphosate ⁴)					
Rodeo	Monsanto	-	0	0	0
Pondmaster	Monsanto	-			
(trichlopyr)					
Renovate 3	Dow Agrosiences	2-8 qt./A	**	0	0
carfentrazone (Stingray)	FMC	-	0	0	0
imazapyr	BASF	-	2	0	0
Galleon SC	Seapro Corp.	10-30 ppb	0	0	0
Clearcast	BASF Corp.	0-500 ppb	0	0	0

¹ Algae control may result in a fish kill due to oxygen depletion if herbicides are applied to large areas, or when dissolved oxygen levels are low, or if fast-acting contact herbicides are used (diquat, copper sulfate, etc.). Similar hazards exist when vascular plants or floating weeds are rapidly killed in large masses with diquat or other herbicides used on emerged or submersed weeds.

² If water is used for drinking, the elemental copper concentration should not exceed 1.0 ppm (i.e. 4.0 ppm copper sulfate.)

³ Do not apply within 0.25 mile of any potable water intake.

⁴ Do not apply within 0.5 mile upstream of potable water intakes.

⁵ Drinking water restriction depends on rate of application. Refer to Reward label.

NL = NOT LABELED FOR APPLICATION TO BODIES OF WATER WITH THIS INTENDED USE.

*Herbicide label does not prohibit use of water for this intended use.

**Drinking water restrictions depend on laboratory analysis, see Garlon 3A label.

AQUATIC WEED CONTROL USE RESTRICTIONS¹ (continued)

(Number of days after treatment before use)

(Common Name) Trade Names	Company	Conc. PPM	Animal Drinking		Irrigation		Agric. Sprays
			Dairy	Livestock	Turf	Crops	
(copper sulfate ²) Copper Sulfate G Copper Sulfate Snow Copper Sulfate Crystal Triangle Copper Sulfate	Tenn. Chem. Tenn. Chem. Tenn. Chem. Triangle	- - -	0 0 0	0 0 0	0 0 0	0 0 0	0
(copper complexes) Cutrine-Plus Cutrine-Plus G K-Tea AquaCure	Applied Biochemists Applied Biochemists Griffin PBI Gordon	- - - -	0	0	0	0	0
(2,4-D) AquaKleen 2,4-D Granules Hardball	Rhone-Poulenc Riverdale Helena	- - -	NL NL	0	NL 0	NL NL NL	NL NL
(diquat) Reward ⁵	Zeneca	-	1	1	1-3	5	5
(endothall) Aquatol G Aquatol K	Atochem	- 0.5 1.0 -3.0	7 7 14	7 7 14	7 7 14	7 7 14	7 7 14
Hydrothol 191 & Hydrothol 191G	Atochem	< .03 0.5	7 14	7 14	7 14	7 14	7 14
(fluridone ³) Sonar AS Sonar SRP	DowElanco DowElanco	- -	0	0	30 30	30 30	* *
(glyphosate ⁴) Rodeo Pondmaster	Monsanto Monsanto	- -	0	0	0	0	0
(trichlopyr) Renovate 3	Dow Agrosciences	2-8 qts./A	0	0	NL	NL	NL
carfentrazone (Stingray)	FMC	-	0-1	0-1	1-14	1-14	0
imazapyr	BASF	-	0	0	120	120	0
Galleon SC	Seapro Corp.	10-30 ppb	0	0	0	1 ppb	1 ppb
Clearcast	BASF Corp.	0-500 ppb	0	0	1 d pr 50 ppb	1 d pr 50 ppb	0

¹ Algae control may result in a fish kill due to oxygen depletion if herbicides are applied to large areas, or when dissolved oxygen levels are low, or if fast-acting contact herbicides are used (diquat, copper sulfate, etc.). Similar hazards exist when vascular plants or floating weeds are rapidly killed in large masses with diquat or other herbicides used on emersed or submersed weeds.

² If water is used for drinking, the elemental copper concentration should not exceed 1.0 ppm (i.e. 4.0 ppm copper sulfate.)

³ Do not apply within 0.25 mile of any potable water intake.

⁴ Do not apply within 0.5 mile upstream of potable water intakes.

⁵ Irrigation water use restriction for turfgrasses and ornamentals depends on rate of application. Refer to Reward label.

NL = NOT LABELED FOR APPLICATION TO BODIES OF WATER WITH THIS INTENDED USE.

*Herbicide label does not prohibit use of water for this intended use.

CALCULATING PESTICIDE CONCENTRATIONS IN AQUATIC SITUATIONS¹

Updated by Gary J. Burtle, Extension Aquaculture and Fisheries

Depending up on the chemical, pesticides a reapplied as a surface acre, bottom acre-foot or total water volume treatment. Total water volume treatments are expressed on a part per million by weight (ppmw) basis. Water volume can be measured in gallons, cubic yards, cubic feet, etc.; however, the most commonly used unit of water volume measurement is acre-feet. The following formula may be used to determine the amount of pesticide formulation required to obtain a desired final concentration (ppmw) in the water of a pond or lake on an acre-feet basis:

$$1. \text{ Concentration based on part per million by weight (ppmw) Amount of formulation} = \frac{A \times D \times CF \times ECC}{I}$$

A = area of the water surface in acres (Use precise measurement or measure from aerial photos).

D = average depth of the pond or lake in feet.

CF = 2.72 lbs./acre foot. The Conversion Factor (CF) when total water volume is express on an acre-feet basis. 2.72 lbs. of a pesticide per acre-foot of water is equal to one ppmw.

ECC = Effective Chemical Concentration of the active ingredient of a pesticide needed in the water to achieve control of the pest.

I = The total amount of active ingredient divided by the total amount of active and inert ingredients. Liquid products usually list the amount of active ingredients as pounds per gallon. For such products:

$$I = \frac{\text{pounds of active ingredients}}{\text{one (1) gallon}}$$

Non-liquid formulations usually list active ingredients as a percentage of the total formulation. For non-liquid formulations:

$$I = \frac{\text{percent active ingredients}}{100\%}$$

The following formula may be used to determine the amount of pesticide formulation on a surface acre basis.

1. Amount of pesticide formulation per surface acre.

$$\text{Amount of formulation} = \text{Surface acres} \times \text{Broad cast formulation rate/acre.}$$

¹ For additional information, refer to UGA Extension Bulletin 866 - "Using Chemicals in Pond Management."