

# AQUATIC ENVIRONMENTS

## FISHERY CHEMICALS

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(PARASITES, PISCICIDES, AND OTHER TREATMENTS)<sup>1</sup>

	CHEMICAL	APPLICATION RATE	CATEGORY OF USE <sup>2</sup>	COMMENTS
Fish Parasites	<i>formalin</i> Parasite-S Formalin-F Formacide-8	15–25 ppm in ponds (4.5–7.5 gal/A-ft)	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 pt/1000 gal in tanks for 1 hour)		In tanks, if stress is excessive, flush with fresh water. Use lower rate in water above 50° F.
Piscicides	<i>rotenone</i> (restricted) Prenfish Toxicant	0.005–0.25 ppm ai (depends on species)	N	Do not use in waters colder than 65° F. This is a <b>restricted use pesticide</b> .
Miscellaneous Aquatic Treatment	<i>tricaine methanesulfonate</i> Tricain-S (anesthetic)	15–66 ppm ai for 6–48 hours for sedation; 50–330 ppm active ingredient for 1–40 minutes for anesthesia	F	21-day pre-slaughter withdrawal period.
	<i>ormetropin + sulfadimethoxine</i> Romet 30 (bactericide)	2.3 g ai/100 lb fish per day for 5 days in feed	F	3-day pre-slaughter withdrawal period for catfish, do not use on trout within 6 weeks of marketing or release as stocker fish. Veterinarian must prescribe.
	<i>oxytetracycline</i> Terramycin (bactericide)	2.5–3.75 g ai/100 lb fish per day for 10 days in feed	F	21-day pre-slaughter withdrawal period. Veterinarian must prescribe.
	<i>florfenicol</i> Aquaflor	10–15 mg/kg fish per day in feed for 10 consecutive days		A veterinarian must prescribe <i>florfenicol</i> . Wait 15 days prior to harvest of fish for human consumption. Approved for use on catfish, salmonids, and freshwater finfish for select bacterial infections.
	<i>calcium hypochlorite</i> (disinfectant & sterilant)	10 ppm available chlorine (38.8 lb/A-foot)	F	Kills all fish and some parasites. Turbid water affects treatment.
	<i>hydrated lime</i> (disinfectant)	1,338 lb/A burnt lime	F	Drained pond treatment. Standing water reduces effect.
		1,784 lb/A slaked lime	F	Drained pond treatment.
	<i>potassium permanganate</i> Proline Potassium Permanganate, 97%	2 ppm (5.4 lb/A-foot) Pond treatment of fish that are not intended for human consumption	N	Treatment may have to be repeated within 24 hours to be effective.* Turbid water affects treatment. Turbid water has a higher permanganate demand and requires repeat treatment or higher rates of application.
	<i>salt (sodium chloride)</i> Brightwell Aquatics Fish Haul-C	0.5–3% (83–250 lb/1000 gal) In live fish hauling tanks.	F	Do not use iodized salt with fish. Various purities and mixes include <i>sodium chloride</i> for fisheries uses. When applying to ponds for indefinite treatment, a concentration of 50–100 mg chloride per liter is targeted.
<i>hydrogen peroxide</i> Perox-aid PAK-27 GreenClean Phycomycin	Warm water at 700–1,000 mg/L for 15 minutes, once per day. Cold water at 500 to 1,000 mg/L	F	0-day withdrawal time.	

1. Adapted from Approved Drugs for use in Aquaculture, 2010. US Fish and Wildlife Service, Aquatic Animal Drug Approval Partnership Program, American Fisheries Society Fish Culture Section, and US Food and Drug Administration Center for Veterinary Medicine.

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.

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

USE STAGE	HERBICIDE	MOA	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
			AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	
Algae	<i>copper sulfate</i> AP Brand Copper Sulfate Crystals		0.85–5.4 lb/A-ft	0.25–2 ppm*	<i>Copper sulfate</i> denatures protein. Apply at early stages in algae development (usually April or May. Repeat as needed. Read and observe all label cautions and instructions. <i>Copper</i> 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 0.25–0.33 of the water body at any one time to avoid fish suffocation caused by oxygen depletion. <i>Copper</i> -containing products may be used for spot treatments of algae. <i>Copper sulfate</i> , <i>copper</i> complexes and <i>diquat</i> may also be used in commercial fish production ponds.
	<i>copper sulfate</i> —acidified liquid Earthtec 20L		1–40 pt*	0.06–2.5 lb	Dosage is variable according to algae species, pH and water temperature. Tank mixing with <i>diquat</i> may allow effective control of vascular plants and <i>copper</i> -resistant algae.
	<i>copper chelates</i> , complexes Cutrine-plus 0.9L Cutrine-plus 3.7G Cutrine Ultra 0.9L K-Tea 0.8L		0.6–1.2 gal* 60 lb/A 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. Tank mixing with <i>diquat</i> may allow effective control of vascular plants and <i>copper</i> -resistant algae. Granular Cutrine-plus is for spot treatment at the rate of 1 lb/720 sq ft. Cutrine Ultra has an adjuvant for algal mat penetration and improved effect.
	<i>diquat</i> Reward 2AS Diquat 2AS Weedtrine D 0.4AS	22	1–2 gal*  3.4–10.2 gal*	2–4 lb  0.5–1.5 ppm*	<i>Diquat</i> is effective for filamentous algae control. Apply <i>Diquat</i> as recommended in SUBMERSED WEEDS section. Use 1 gal Reward/surface acre in water with an average depth of 2 ft. The higher rate may be used in water with an average depth greater than 2 ft. Repeat applications will be necessary. REI 24 hours. Use a sinking adjuvant for infestations in deep water.
	<i>endothall</i> — <i>dimethylalkylamine</i> Hydrothol 191 5G Hydrothol 191 2AS		3–81 lbA-ft 0.6–1.8 pt/A-ft	0.05–1.5 ppm 0.05–1.5 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.
	<i>flumioxazin</i> Clipper 51WG	14	6–12 oz/surface-A	0.36–0.71 lb	Disperse in 50–100 gal/A and buffer pH 5–7. Test water for pH. Apply <i>flumioxazin</i> in early morning when pH is less than 7 to avoid chemical degradation.
	<i>dyes and colorants</i> Aquashade Crystal Blue Blue Vail		1 gal/4 A ft	1 ppm	Aquashade is a non-toxic blue dye that controls filamentous algae by blocking light penetration for up to 6 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 1 gal Aquashade/1 A of water that averages 4 ft deep in the early spring before weed growth begins, or apply when weeds can 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.
	<i>sodium carbonate peroxyhydrate</i> PAK-27 27G GreenClean Liquid 27.1L phycomycin		8–90 lb/A-ft 4–45 lb/A-ft 3–100 lb/A-ft 1.2–12 gal/A		<i>Sodium carbonate peroxyhydrate</i> oxydizes <i>chlorophyll</i> and liberates <i>hydrogen peroxide</i> when wet. Wide range of application rates indicates variable response by algal species. Filamentous algae requires higher rates than planktonic algae. This product does not have residual effect on algae longer than 24 hours. May improve herbicidal effect of <i>copper</i> -containing algaecides when used on algal species with mucilaginous coating.

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

## AQUATIC WEED CONTROL

USE STAGE	HERBICIDE	MOA	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
			AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	
Floating Weeds (Also see Floating Plants)	<i>diquat</i> Diquat 2AS Reward 2AS Weedtrine D 0.4AS	22	1 gal 5 gal	2 lb 2 lb	Spray to wet exposed plants with 50–150 gal of water/A plus 1 pt of nonionic surfactant/100 gal of spray mix. Do not apply to muddy water. Labeled also for commercial fish production ponds. Consider tank mixes with chelated <i>copper</i> formulations for resistant duckweeds.
	<i>fluridone</i> Sonar AS 4EC Alligare Fluridone 4AS	12	0.25–2 qt	0.25–2 lb	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.
	2,4-D Weedar 64 3.8EC	4	2–4 qt/A	1.9–3.8 lb/A	Controls water hyacinth. Do not apply to open water. Apply only to dense stands. Treat only 0.33–0.5 of the water body to avoid oxygen depletion problems.
	<i>imazapyr</i> Habitat 2AS	2	See label	See label	Use of spreader-stickers will improve results. Ensure complete coverage by applying with 100 gal water/A.
	<i>carfentrazone</i> Stingray 1.9EC	14	3.4–13.5 oz	0.025–0.2 lb	Use a non-ionic surfactant and 100 gal of dilution water per surface area. 80% of foliage should be exposed to treatment. Use tank mixes with 2,4-D, <i>glyphosate</i> , or <i>diquat</i> products for better control at the lower rates of application.
	<i>flumioxazin</i> Clipper 51G, Propeller 51WG	14	6–12 oz/A	0.36–0.71 lb	Disperse in 50–100 gal/A and buffer to pH 5–7. Three to four times these rates for submerged aquatic weeds. Test water for pH.
	<i>glyphosate</i> Rodeo and others	9	1 gal + activator	¼ lb/A	Apply with spreader-activator like AquaKing Plus in 25–100 gallons of dilution water per acre for duckweed control.
Emersed Weeds (Also see Floating Plants)	2,4-D Aqua-Kleen 19G Navigate 19G Weedar 64 3.8EC	4	100–200 lb 100–200 lb 2–4qt/A	19–38 lb 27.6–55.2 lb 1.9–3.8 lb	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 half of the pond in any 1 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.
	<i>glyphosate</i> Rodeo 5.4EC Alligare Glyphosate 5.4EC AquaNeat 5.4EC ShoreKlear 5.4EC	9	See label. 0.75–1.5% solution is typical for spottreatment.		Apply after drawdown or when water is present. Allow 7 or more days after drawdown treatment before reintroduction of water (apply within 1 day after drawdown). Add 2 qt of a manufacturer approved surfactant/100 gal of spray solution.
	<i>fluridone</i> Sonar 4AS Alligare Fluridone 4AS	12	1–2qt/A	45–90 ppb	Apply <i>fluridone</i> liquids as a surface spray, or near the bottom with weighted trailing hoses or meter into pumping system. Trees or shrubs growing in water treated with <i>fluridone</i> may be injured. Thirty to 90 days are required before desired weed control is achieved. The emersed weeds treated with <i>fluridone</i> are spatterdock and water lily.
	<i>imazapyr</i> Arsenal 2 SL Habitat 2SL Imazapyr 4SL	2	1–6 pt/A, See label		Use of spreader-stickers will improve results. Ensure complete coverage by applying with 100 gal water/A. Consider rotating <i>imazapyr</i> use with 2,4-D or <i>glyphosate</i> products to slow resistance in weed populations.
	<i>carfentrazone</i> Stingray 1.9EC	14	3.4–13.5 oz	0.025–0.2 lb	Use a non-ionic surfactant and 100 gal of dilution water per surface area. 80% of foliage should be exposed to treatment. Use tank mixes with 2,4-D, <i>glyphosate</i> , or <i>diquat</i> products for better control at the lower rates of application.
	<i>triclopyr</i> Renovate 3 3EC	4	0.25–3 gal	0.75–9 lb	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.

USE STAGE	HERBICIDE	MOA	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
			AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	
Submersed Weeds	<i>copper complexes</i> Komeen 8 L	n/a	1.7–3.3 gal/A-ft	0.5–1.0 ppm	Use Komeen for ponds with crop irrigation for most submerged aquatic weeds. Test water for alkalinity or hardness.
	<i>diquat</i> Reward 2AS Diquat 2AS Weedtrine D 0.4AS	22	1–2 gal 5–10 gal	2–4 lb 2–4 lb	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.
	<i>2,4-D</i> Aqua-Kleen 19G Navigate 19G Weedar 64 3.8EC	4	100–200 lb 2.5–10 gal/A	19–38 lb 4.3–17 lb/A	See comments for granular formulations in “Emerged Weeds” section. Effective on parrotfeather, coontail and Eurasian watermilfoil. Also labeled for commercial fish production ponds.
	<i>endothall</i> Aquathol 10.1G Aquathol Super K 63G Aquathol K 4.2AS Hydrothol 5G Hydrothol 191 2AS		13–81 lb* 0.3–1.9 gal* 3–27 lb* 0.6 pt–0.7 gal*	0.5–3 ppm* 0.5–3 ppm* 0.05–0.5 ppm* 0.05–0.5 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.
	<i>bispyribac</i> Tradewind 80SP	2	0.8–2.4 oz/A-ft	20–40 ppb 0.8–1.6 oz/A-ft	Use when pond has limited out flow, 3–4 months of contact needed for best effect. Not recommended for late summer application. Irrigation and livestock watering restrictions.
	<i>dyes and colorants</i> Aquashade Crystal Blue Blue Vail		1 gal/4 A ft	1 ppm	Aquashade is a non-toxic dye that controls several submersed weeds, such as naiads, by blocking light penetration for up to 6 weeks after application. May be used in lakes, ponds, ornamental ponds and fountains, as well as commercial fish production ponds that have little or no outflow. Apply 1 gallon of Aquashade/1 A of water that averages 4 ft 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.
	<i>florpyrauxyfen-benzyl</i> ProcellaCor EC 2.7% AI	4	Varies by Prescription	Varies by Prescription	Prescription Dose Unit (PDU) obtained from certified applicator or SePRO Corp. Long term control of bacopa, hydrilla, milfoil, alligatorweed, and azola. PDU rate of 1–25 per A-ft with one PDU equal to 3.7 fl. oz. depending on area treated and weed species.
	<i>fluridone</i> Sonar AS 4, Alligare Fluridone Sonar One 5G	12	1–2qt/A Up to 5lb/A-ft	45–90 ppb 30–90 ppb	Check label for susceptible weeds. Trees or shrubs growing in water or having roots growing in water treated with <i>fluridone</i> may be injured. Thirty to 90 days will be required before desired weed control is achieved. Multiple applications may be needed where dilution of the treated area occurs.
	<i>flumioxazin</i> Clipper 51G	14	Not more than 14.8 lb/surface acre	0.1–0.4 ppm	Disperse in 50–100 gal/A and buffer to pH 5–7. Test water for pH.
	<i>topramezone</i> Oasis 2.8AS	27	3.1–5 oz/A-ft	25–40 ppb 1–1.6 oz/A-ft	Slow acting so the risk of oxygen depletion is not likely. Apply in late winter to early spring. Irrigation restrictions apply. Use in static water.

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

■ AQUATIC WEED CONTROL

USE STAGE	HERBICIDE	MOA	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
			AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	
Floating Plants	<i>penoxsulam</i> Galleon SC 2	2	2–5.6 oz	0.031–0.087 lb	Do not use pond to irrigate food crops unless analyses show less than 1 ppb residue. Do not use in successive years.
	<i>imazamox</i> Clearcast 1 AS Clearcast 2.7G	2	16–128 oz/A 5–20 lb/A-ft	Up to 500 ppb	Spot spray foliage with 0.25–5% solutions in water with a surfactant. Treat submerged vegetation at 50–300 ppb for most aquatic weeds. Granules for shoreline and spot treatment.
Emerald Weeds	<i>penoxsulam</i> Galleon SC 2	2	2–5.6 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.
	<i>imazamox</i> Clearcast 1 AS	2	32–64 oz	0.24–0.5 lb	Spot spray foliage with 0.25–5% solutions in water with a surfactant.
Drawdown Application	<i>penoxsulam</i> Galleon SC 2	2	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.
	<i>imazamox</i> Clearcast 1 AS	2	64 oz	0.5 lb	Wait 2 weeks before re-flooding the pond.
	<i>glyphosate</i> Rodeo, Touchdown Pro, Aquaneat	9	See label		After draw down and <i>glyphosate</i> application wait 7 days before filling pond with water.

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

NOTE: Follow label for tank mixing combinations of these products. The mix of *2,4-D* and *triclopyr* is commercially available as Renovate Max G. Follow label for rate of application.

# RESPONSE OF COMMON AQUATIC WEEDS TO HERBICIDES<sup>1</sup>

AQUATIC GROUP	WEED	COPPER COMPLEXES, COPPER SULFATE	2,4-D DIMETHYLAMINE (MOA: 4)	DIQUAT (MOA: 22)	ENDOTHA (MOA: NC)	FLUMIOXAZIN (MOA: 14)	FLURIDONE (MOA: 14)	GLYPHOSATE (MOA: 9)	CARFENTRAZONE (MOA: 14)	TRICLOPYR (MOA: 4)	IMAZAPYR (MOA: 2)	IMAZAMOX (MOA: 2)	
Algae	planktonic	E	P	P		G	P	P	NR	NR	NR	NR	
	filamentous	E	P	E	G <sup>2</sup>	E	P	P	NR	NR	NR	NR	
	chara	E	P	G	G <sup>2</sup>		P	P	NR	NR	NR	NR	
	nitella	E	P	G	G <sup>2</sup>		P	P	NR	NR	NR	NR	
Floating Weeds	bladderwort	P	G <sup>3</sup>	E		E	E		—		NR		
	duckweeds	P	P	G <sup>5</sup>	P		E	G <sup>6</sup>	G	P	G		
	salvinia	G	P	G	P	E	E	G	G	P	P	E	
	water hyacinth	P	E	E			P	F	G	P-E	G		
	watermeal	P	P	P <sup>5</sup>		E	G	P	P	NR	NR		
Emerged Weeds	alders	P	E	F	P		P	E	—	—	—	G	
	alligatorweed	P	F	P	P		G	E	F	G	G	E	
	American lotus	P	E	P	P		F	G	—	G	G	G	
	arrowhead	P	E	G	G			E	—	—	—	G	
	buttonbush	P	E	F	P		P	G	—	—	—	G	
	cattails	P	G	G	P		F	E	—	F	E	E	
	fragrant & white waterlily	P	E	P	P		E	E	—	G	E	E	
	frogbit	P	E	E		E						E	
	maidencane	P	P	F			F	E	—	—	—	—	
	pickerelweed	P	G	G			P	F	—	NR	E	E	
	pond edge										—		
	annuals	P		G	P		F	E	—	—	E	E	
	sedges/rushes	P	F	F			P	G	—	NR	G	G	
	slender spikerush	P	P	G <sup>5</sup>		G	G	P	—	NR	—	G	
	smartweed	P	E	F			F	E	—	EF	E	E	
	spatterdock	P	E	P			E	G-E	—	—	E	E	
	So. watergrass	P	P				G	E	—	NR	—	—	
	torpedograss	P	P	P			F	G	—	P	E	E	
	watershield	P	E	P	P			G	G	—	—	P	E
	water pennywort	P	G	G		E	P	G	—	G	—	—	
water primrose	P	E	F	P			F	E	F	—	E	E	
willows	P	E	F				P	E	—	—	—	G	

■ RESPONSE OF COMMON AQUATIC WEEDS TO HERBICIDES

AQUATIC GROUP	WEED	COPPER COMPLEXES, COPPER SULFATE	2,4-D DIMETHYLAMINE (MOA: 4)	DIQUAT (MOA: 22)	ENDOTHA (MOA: NC)	FLUMIOXAZIN (MOA: 14)	FLURIDONE (MOA: 14)	GLYPHOSATE (MOA: 9)	CARFENTRAZONE (MOA: 14)	TRICLOPYR (MOA: 4)	IMAZAPYR (MOA: 2)	IMAZAMOX (MOA: 2)
Submersed Weeds	watermilfoil	P	G	E	E	E	E	P	—	G	NR	
	coontail	P	P	G	F	E	E	P	—	NR	NR	G
	egeria	P		E	F	E	E	P	—	NR	NR	—
	elodea	P	E	E	E	E	E	P	—	E	NR	—
	eurasian watermilfoil	P	F	G	E	E	E	P	G	NR	NR	G
	fanwort	F <sup>4</sup>	P	G	G	E	E	P	—	NR	NR	—
	hydrilla	P	F	E	E	E	E	P	—	NR	NR	G
	naiads	P <sup>4</sup>	E	E	E	E	F	F	—	E	NR	—
	parrotfeather	F <sup>4</sup>	E	E	E	G	E	NR	—	E	NR	G
	pondweeds (Potamogeton)	P <sup>4</sup>	P	G	E	E	E	P	NR	NR	NR	G

1. E—excellent control (90–100%)  
 G—good control (80–89%)  
 F—fair control (70–79%)  
 P—poor control (<70%)  
 NR—Not recommended  
 — Insufficient data  
 A blank space indicates weed response is not known.
2. *Hydrothol* formulations only.

3. Granular 2,4-D formulations.
  4. *Copper* complexes only. Fair to good control can be achieved with Komeen.
  5. Cutrine Plus: Reward, 3:2 or 1:1 tank mix will improve response.
  6. Use a spreader/activator adjuvant for floating aquatic plants.
- Note:** *Penoxsulam* and *Imazamox* have been recently labeled for control of floating, emergent, and submersed plants, but the labels should be consulted for a list of plants controlled or partially controlled by these herbicides.

# AQUATIC WEED CONTROL USE RESTRICTIONS<sup>1</sup>

Gary J. Burtle, Extension Aquaculture and Fisheries

(NUMBER OF DAYS AFTER TREATMENT BEFORE USE)

COMMON NAME TRADE NAME	COMPANY	RE-ENTRY TIME (H)	CONC. PPM	HUMAN			ANIMAL DRINKING		IRRIGATION		AGRIC. SPRAYS
				DRINKING	SWIMMING	FISH CONSUMPTION	DAIRY	LIVESTOCK	TURF	CROPS	
<i>copper sulfate</i> <sup>2</sup>											
Copper Sulfate G	Tenn. Chem.	***App	—	0	0	0	0	0	0	0	0
Copper Sulfate Snow	Tenn. Chem.		—	0	0	0	0	0	0	0	0
Copper Sulfate Crystal	Tenn. Chem.		—	0	0	0	0	0	0	0	0
Triangle Copper Sulfate	Triangle			0	0	0	0	0	0	0	0
<i>copper complexes</i>											
Cutrine-Plus	Applied Biochemists	App	—	0	0	0	0	0	0	0	0
Cutrine-Plus G	Applied Biochemists		—								
K-Tea	Griffin		—								
AquaCure	PBI Gordon		—								
<i>2,4-D</i>											
Aquakleen	Rhone-Poulenc	App	—	NL	0	0	NL	0	NL	NL	NL
2,4-D Granules	Riverdale		—	7	1	0	7	7	0	7	7
Hardball	Helena		—		0	0	0	0	0	7**	7***
<i>diquat</i>											
Reward <sup>5</sup>	Zeneca	App till dry	—	1–3	0	0	1	1	1–3	5	5
<i>endothall</i>											
Aquathol G	Atochem	24	0.5	7	1	3	7	7	7	7	7
Aquathol K	Atochem		1.0–3.0	14	1	3	14	14	14	14	14
Hydrothol 191	Atochem	24	< 0.3	7	*	3	7	7	7	7	7
Hydrothol 191G	Atochem		0.5	14	*	3	14	14	14	14	14

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 ppm (i.e. 4 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.
- \*\*\* Only properly protected workers are allowed in the area during treatment of *copper sulfate* and *copper*-containing algicides.



■ AQUATIC WEED CONTROL USE RESTRICTIONS

AQUATIC ENVIRONMENTS

COMMON NAME TRADE NAME	COMPANY	RE-ENTRY TIME (H)	CONC. PPM	HUMAN			ANIMAL DRINKING		IRRIGATION		AGRIC. SPRAYS
				DRINKING	SWIMMING	FISH CONSUMPTION	DAIRY	LIVESTOCK	TURF	CROPS	
<i>fluridone</i> <sup>3</sup>											
Sonar AS	DowElanco	App	—	0	0	0	0	0	30	30	*
Sonar SRP	DowElanco		—	0	0	0	0	0	30	30	*
<i>glyphosate</i> <sup>4</sup>											
Rodeo	Monsanto	App	—	0	0	0	0	0	0	0	0
Pondmaster	Monsanto		—	0	0	0		0			
<i>trichlopyr</i>											
Renovate 3	Dow Agrosiences	App till dry	2–8 qt./A	**	0	0	0	0	NL	NL	NL
<i>carfentrazone</i>											
Stingray	FMC	App	—	0	0	0	0–1	0–1	1–14	1–14	1–14
<i>imazapyr</i>											
Habitat	BASF	App	—	2	0	0	0	0	120	120	0
<i>penoxsulam</i>											
Galleon SC	Seapro Corp.	App	10–30 ppb	0	0	0	0	0	0	1 ppb	1 ppb
<i>imazomox</i>											
Clearcast	BASF Corp.	App	0–500 ppb	0	0	0	0	0	1 d pr 50 ppb	1 d pr 50 ppb	0
<i>flumioxazin</i>											
Clipper	Valent	App	100–400 ppb	0	0	0	0	0	5	5	5
<i>bispyribac</i>											
Tradewind	Valent	App	20–45 ppb (Human)  ≤ 1ppb (Animals and Irrigation)	0	0	0	≤ 1ppb	≤ 1ppb	≤ 1ppb	≤ 1ppb	≤ 1ppb

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 ppm (i.e. 4 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.
- \*\* Drinking water restrictions depend on laboratory analysis, see Renovate 3 label.
- \*\*\* 2,4-D treated water should not be used for grapes, nursery crops or any sensitive crop irrigation or spray mix until 7 days post-treatment, or assay of less than 0.1 ppm.

# CALCULATING PESTICIDE CONCENTRATIONS IN AQUATIC SITUATIONS<sup>1</sup>

Gary J. Burtle, Extension Aquaculture and Fisheries

Depending on the chemical, pesticides are applied 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. Concentration based on part per million by weight (ppmw)

$$\text{Amount of formulation} = \frac{A \times D \times CF \times ECC}{I}$$

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 lb/A foot. The Conversion Factor (CF) when total water volume is expressed on an acre-feet basis. 2.72 lb of a pesticide/A-ft of water is equal to 1 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:

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

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.

$$\text{Amount of formulation} = (\text{Surface acres}) \times (\text{Broadcast formulation rate/A})$$

1. For additional information, refer to UGA Extension Bulletin 866—“Using Chemicals in Pond Management.”