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Biology and Control of Hydrilla With Herbicides¹

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Hydrilla

Hydrilla [*Hydrilla verticillata* (L.f.) Royle] has been reported in Florida since 1958, although it was originally identified as Florida Elodea. This rapidly growing, submerged aquatic weed crowds out native vegetation in many areas to become the dominant plant in a body of water. Hydrilla efficiently reproduces vegetatively by several methods. It can spread rapidly through a body of water by fragmentation of existing Hydrilla shoots. If the shoots of the plant are removed by some means, such as by treatment with a herbicide or by a mechanical operation, there is usually rapid regrowth through growth of two kinds of specialized buds, known as *subterranean turions* (commonly called “tubers”) and *axillary turions*, which are formed by the plant. The subterranean turions form at the end of rhizomes in the hydrosol near the base of the Hydrilla shoot, while the axillary turions form at times in the leaf axils on the shoot. There can also be regrowth from the Hydrilla rootstocks that remain in the soil.

Herbicide Selection

One may use biological or mechanical methods to control Hydrilla. If herbicides are used, certain aquatic herbicides are labeled specifically for control of Hydrilla in certain sites. The herbicides registered for use in Florida to control Hydrilla are shown in Table 1. This table also contains information on the application rates, and a summary of the application instructions for each product.

When selecting a herbicide for Hydrilla control, one should consider such things as the type of aquatic site to be treated, the size of the weed infestation, and the uses of the water.

The length of Hydrilla control that can be expected after a herbicide treatment will vary from several weeks to six months or more. This will depend on a combination of factors such as: the number of propagules (turions) present in the soil, the water quality, the clarity of the water, the length of time the weed infestation has been present, the depth of the water, the time of year the treatment is made, the particular herbicide used, and the severity of the weed infestation being treated. Information on the active ingredient sites where each particular

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product may be applied, and use precautions, is contained in Table 2.

Table 1. Herbicides Labeled For Hydrilla Management with Application Rates and Selected Use Directions.

Herbicide Trade Names	Application Rate	Selected Application Suggestions
Algae Pro	Tank mix or direct withdrawal	(1) Inject mixture of 4.0 gal per acre product with 2.0 gal per acre Reward in 100 gal spray mixture per acre. Or (2) Apply 2.0 – 5.0 gal product with label rate of Sonar per acre.
AquaPlex	0.4 – 1.0 ppmw	Inject in a water carrier in a spray mixture of 50 – 100 gal per acre.
Aquathol K	0.6 – 1.9 gal per acre-foot	Inject evenly over the treatment area in at least 50 gal of spray mixture per acre. Apply in a water carrier. May be applied as an invert or with a polymer.
Aquathol Super K Granular Aquatic Herbicide	8.8 – 13.2 lbs per acre-foot (pond or large treatment area) 13.2 – 17.6 lbs per acre-foot (spot or marginal treatment)	Apply evenly over the treatment area.
Avast!	0.16 – 0.25 qts per acre-foot (ponds) 0.04 – 0.05 qts per acre-foot (whole lakes or reservoirs)	Apply evenly over the treatment area by aircraft, boat, or from shore. Split treatments may improve control. Metered application may be used in slowly flowing water. Movement of treated water from water body may reduce control.
Avast! SRP	2.5 – 5.0 lbs per acre foot (ponds) 0.9 – 5.0 lbs per acre foot (lakes and reservoirs)	Apply evenly over the treatment area by aircraft, boat, or from shore. Split treatments may improve control. Metered application may be used in slowly flowing water. Movement of treated water from water body may reduce control.
Captain	0.4 – 1.0 ppmw	Inject in a water carrier in the treatment area. Use lower rates for light infestations. May be tank mixed at the rate of 3.3 gal product with 2.0 gal diquat (2.0 lb ae per gal) and applied to one acre of water by injection in at least 50 gal spray mixture per acre. May be applied as an invert or with a polymer.
Clearigate	3.6 – 8.7 gal per acre-foot	Inject into the treatment area in a water carrier.
Cutrine-Plus	0.4 – 1.0 ppmw	Inject in a water carrier in the treatment area. Use lower rates for light infestations. May be tank mixed at the rate of 3.0 gal product with 2.0 gal Reward and applied to one acre of water by injection in at least 50 gal spray mixture per acre. May be applied as an invert or with a polymer.

Table 1. Herbicides Labeled For Hydrilla Management with Application Rates and Selected Use Directions.

Herbicide Trade Names	Application Rate	Selected Application Suggestions
Hydrothol 191	1.4 – 2.7 gal per acre-foot (lakes and ponds) 1.4 – 2.7 gal per acre-foot (irrigation and drainage canals) 4.0 – 6.75 gal per acre-foot (irrigation and drainage canals)	Due to fish toxicity, use of this product is suggested only by commercial applicators on a marginal or spot treatment rather than a full treatment of a water body. Inject evenly over the treatment area in at least 50 gal of spray mixture per acre. Apply in a water carrier. May be applied with a polymer. Do not treat more than 1/10 of a lake or pond with rates over 1.0 ppmw.
Hydrothol 191 Granular	54 – 108 lbs per acre-foot	Due to fish toxicity, use of this product is suggested only by commercial applicators on a marginal or spot treatment rather than a full treatment of a water body. Apply evenly over the treatment area. Do not treat more than 1/10 of a lake or pond with rates over 1.0 ppmw.
Komeen	(1) 0.75 – 1.0 ppmw (2) Tank mix or direct withdrawal	Inject in a water carrier. May be applied as an invert or with a polymer. May be tank mixed or applied with a direct withdrawal pump in the following mixes: (1) 4.0 gal product with 2.0 gal diquat (2.0 lb ae per gal); or (2) 4.0 gal product with 3.0 gal Aquathol K.
K-TEA	Tank mix or direct withdrawal	Inject mixture of 4.0 gal per acre product with 2.0 gal per acre Reward in 100 gal spray mixture per acre. Apply in a water carrier in a least
Nautique	Tank mix or direct withdrawal	(1) Inject mixture of 4.0 gal per acre product with 2.0 gal per acre Reward in 100 gal spray mixture per acre. Or (2) Apply 1.0 – 4.0 gal product with label rate of Sonar per acre.
Reward	2.0 gal per acre	Inject in the treatment area in at least 100 gal spray mixture per acre. May be applied as an invert or with a polymer. To enhance control, tank mix or apply with a direct withdrawal pump at the rate of 2.0 gal produce with 4.0 gal of chelated copper (0.9 lb ai per gal).
Sonar A.S.	45 – 90 ppbw (ponds) 10 – 90 ppbw (lakes or reservoirs) 1.0 – 2.0 qts per acre (static canals) 15 – 40 ppbw (flowing canals – maintain 45 days)	Apply evenly over the treatment area by aircraft, boat, or from shore. Split treatments may improve control. Metered application may be used in slowly flowing water. Movement of treated water from water body may reduce control.
Sonar SRP	45 – 90 ppbw (ponds) 16 – 90 ppbw (lakes or reservoirs) 20 – 40 lbs per acre (static canals) 10 – 40 ppbw (flowing canals – maintain 45 days)	Apply evenly over the treatment area by aircraft, boat, or from shore. Split treatments may improve control. Metered application may be used in slowly flowing water. Movement of treated water from water body may reduce control.

Table 2. Herbicides Labeled For Hydrilla Management with Application Sites, Active Ingredients and Use Precautions.

Herbicide Trade Name	Application Sites	Active Ingredient	Use Precautions
Algae Pro	bays (quiescent or slow moving); canals (quiescent or slow moving); coves (quiescent or slow moving); ditches (quiescent or slow moving); fire ponds (quiescent of slow moving); fish hatcheries (quiescent or slow moving); fish ponds (quiescent or slow moving); fresh water lakes (quiescent or slow moving); golf course ponds (quiescent or slow moving); irrigation conveyance systems (crop and non-crop); irrigation ponds (quiescent or slow moving); laterals (quiescent or slow moving); ornamental ponds (quiescent or slow moving); potable water reservoirs (quiescent or slow moving); rivers (quiescent or slow moving); streams (quiescent or slow moving)	copper	To reduce the possibility of fish toxicity from oxygen depletion, treatments should not exceed 1/3 to 1/2 of the water body, with 10 –12 days between treatments. This is more critical with high water temperatures. Treat from the shoreline out to avoid trapping fish in water with concentrated herbicide.
AquaPlex	canals; crop and non-crop irrigation conveyance systems; ditches; farm ponds; fish hatcheries; fish ponds; golf course ponds; industrial ponds; irrigation ponds; lakes; laterals; ornamental ponds; potable water reservoirs; swimming areas	copper	To reduce the possibility of fish toxicity from oxygen depletion, treatments should not exceed 1/3 to 1/2 of the water body, with two weeks between treatments. This is more critical with high water temperatures. Treat from the shoreline out to avoid trapping fish in water with concentrated herbicide.

Table 2. Herbicides Labeled For Hydrilla Management with Application Sites, Active Ingredients and Use Precautions.

Herbicide Trade Name	Application Sites	Active Ingredient	Use Precautions
Aquathol K	bayous (quiescent or moving); canals (quiescent or moving); drainage canals; drainage ditches (quiescent or moving); irrigation canals; lakes; lakes (quiescent or moving); marshes (quiescent or slow moving); ponds; ponds (quiescent or moving); potable water; reservoirs (quiescent or moving); rivers (quiescent or moving); streams (quiescent or moving)	endothall	Do not use fish from treated areas for food or feed within 3 days of treatment. Do not use water from treated areas for watering livestock, for preparing agricultural sprays for food crops, for irrigation or for domestic purposes within the following periods: up to 0.5 ppmw dipotassium salt – 7 days after treatment; up to 4.25 ppmw dipotassium salt – 14 days after treatment; up to 5.0 ppmw dipotassium salt – 25 days after treatment.
Aquathol Super K Granular Aquatic Herbicide	canals; drainage ditches; lakes; ponds; reservoirs; rivers; streams	endothall	Do not use water from treated areas for irrigation, for agricultural sprays on food crops or for domestic purposes within 7 days of treatment. Do not use fish from treated areas for food or feed within 3 days of treatment.
Avast!	canals; canals (static); drainage canals; irrigation canals; lakes; ponds (fresh water); reservoirs; rivers; potable water intakes (not at application rates greater 20 ppbw within 1/4 mile of any functioning potable water intake)	fluridone	Delay irrigation from ponds and static canals of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 30 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 30 days. Delay irrigation from canals of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 14 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 30 days. Delay irrigation from lakes and reservoirs of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 14 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 14 days. Do not apply product within 1/4 mile of a functioning potable water intake.

Table 2. Herbicides Labeled For Hydrilla Management with Application Sites, Active Ingredients and Use Precautions.

Herbicide Trade Name	Application Sites	Active Ingredient	Use Precautions
Avast! SRP	canals; canals (static); drainage canals; irrigation canals; lakes; ponds (fresh water); potable water intakes (not at application rates greater 20 ppb within 1/4 mile of any functioning potable water intake); reservoirs; rivers	fluridone	Delay irrigation from ponds and static canals of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 30 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 30 days. Delay irrigation from canals of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 7 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 30 days. Delay irrigation from rivers of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 7 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 7 days. Delay irrigation from lakes and reservoirs of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 7 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 7 days. Do not apply at rates greater than 20 ppbw within 1/4 mile of a functioning potable water intake. Do not apply at rates greater than 20 ppbw within 1/4 mile of a functioning potable water intake.
Captain	canals; ditches; fire ponds; fish hatcheries; fish ponds; golf course ponds; irrigation systems (crop and non-crop); lakes; laterals; ornamental ponds; ponds; potable water sources; reservoirs; rivers; slow flowing or quiescent bodies of water; swimming ponds	copper	Do not treat more than 1/2 of a water body at one time to avoid depletion of oxygen levels due to decaying vegetation.

Table 2. Herbicides Labeled For Hydrilla Management with Application Sites, Active Ingredients and Use Precautions.

Herbicide Trade Name	Application Sites	Active Ingredient	Use Precautions
Clearigate	canals; ditches; farm ponds; fish ponds; golf course ponds; industrial ponds; irrigation conveyance systems (crop and non-crop); lakes; laterals; potable water reservoirs; swimming ponds	copper	Due to possible fish toxicity, treatment rates above 0.5 ppmw should only be used by experienced applicators. In areas where fish are not present or where some fish kill is not objectionable, total volume treatments can be made. In all other areas, treatments at rates above 0.5 ppmw copper should not be made to more than 1/3 to 1/2 of the water body, with one to two weeks between treatments.
Cutrine-Plus	canals; ditches; farm ponds; fish hatcheries; fish ponds; fish raceways; industrial ponds; irrigation conveyance systems (crop and non-crop); lakes; laterals; potable water reservoirs	copper	Allow one to two weeks between consecutive treatments.
Hydrothol 191	drainage canals; irrigation canals; lakes; ponds	endothall	Due to fish toxicity, use of this product is suggested only by commercial applicators on a marginal or spot treatment rather than a full treatment of a water body. Use rates over 1.0 ppmw only on very narrow margins or in areas where some fish kill is not objectionable. Do not treat more than 1/10 of a lake or pond with rates over 1.0 ppmw. Do not use fish from treated areas for food or feed within 3 days of treatment. Do not use water from treated areas for watering livestock, for preparing agricultural sprays for food crops, for irrigation or for domestic purposes within the following periods: up to 0.5 ppmw dipotassium salt – 7 days after treatment; up to 4.25 ppmw dipotassium salt – 14 days after treatment; up to 5.0 ppmw dipotassium salt – 25 days after treatment.

Table 2. Herbicides Labeled For Hydrilla Management with Application Sites, Active Ingredients and Use Precautions.

Herbicide Trade Name	Application Sites	Active Ingredient	Use Precautions
Hydrothol 191 Granular	drainage canals; irrigation canals; lakes; ponds	endothall	Due to fish toxicity, use of this product is suggested only by commercial applicators on a marginal or spot treatment rather than a full treatment of a water body. Use rates over 1.0 ppmw only on very narrow margins or in areas where some fish kill is not objectionable. Do not treat more than 1/10 of a lake or pond with rates over 1.0 ppmw. Fish may be killed by treatment rates above 0.3 ppmw.
Komeen	fire ponds (quiescent or slow moving); fish hatcheries; fish ponds (quiescent or slow moving); fresh water lakes; golf course ponds (quiescent or slow moving); ornamental ponds (quiescent or slow moving); potable water reservoirs (quiescent or slow moving); recreational lakes (quiescent or slow moving)	copper	To reduce the possibility of fish toxicity from oxygen depletion, treatments should not exceed 1/3 to 1/2 of the water body, with 10 –14 days between treatments. This is more critical with high water temperatures. Treat from the shoreline out to avoid trapping fish in water with concentrated herbicide.
K-TEA	bays (quiescent or slow moving); canals (quiescent or slow moving); coves (quiescent or slow moving); ditches (quiescent or slow moving); fire ponds (quiescent or slow moving); fish hatcheries (quiescent or slow moving); fish ponds (quiescent or slow moving); fresh water lakes (quiescent or slow moving); golf course ponds (quiescent or slow moving) irrigation conveyance systems (crop and non-crop - quiescent or slow moving); irrigation ponds (quiescent or slow moving); laterals (quiescent or slow moving); ornamental ponds (quiescent or slow moving); potable water reservoirs (quiescent or slow moving); rivers (quiescent or slow moving); streams (quiescent or slow moving)	copper	To reduce the possibility of fish toxicity from oxygen depletion, treatments should not exceed 1/3 to 1/2 of the water body, with 10 –14 days between treatments. This is more critical with high water temperatures. Treat from the shoreline out to avoid trapping fish in water with concentrated herbicide.

Table 2. Herbicides Labeled For Hydrilla Management with Application Sites, Active Ingredients and Use Precautions.

Herbicide Trade Name	Application Sites	Active Ingredient	Use Precautions
Nautique	aquaculture (including fish and shrimp); canals; ditches; fire ponds; fish ponds; golf course ponds; irrigation systems (crop and non-crop); lakes; laterals; ornamental ponds; ponds; potable water sources; reservoirs; rivers; slow flowing or quiescent bodies of water; swimming ponds	copper	To reduce the possibility of fish toxicity from oxygen depletion, treatments should not exceed 1/3 to 1/2 of the water body, with 10 –12 days between treatments. This is more critical with high water temperatures. Treat from the shoreline out to avoid trapping fish in water with concentrated herbicide.

Table 2. Herbicides Labeled For Hydrilla Management with Application Sites, Active Ingredients and Use Precautions.

Herbicide Trade Name	Application Sites	Active Ingredient	Use Precautions
Reward	bayous (public waters); canals (public waters); drainage ditches (public waters); drainage ditches (still water, where there is minimal or no outflow to public waters); flowing waters (rivers, streams, canals) not within 1600 feet upstream or within 400 feet downstream of operating potable water intake sites; lakes (public waters); lakes (still water, where there is minimal or no outflow to public waters); marshes (public waters); ponds (public waters); ponds (still water, where there is minimal or no outflow to public waters); quiescent or slow moving bodies of water; reservoirs (public waters); rivers (public waters); standing water (lakes, reservoirs) not within 1400 feet for rates of 2 gal/acre or within 700 feet for rates at 1 gal/acre or within 350 feet for rates equal to or less than 0.5 gal/acre of potable water intake sites; streams (public waters); ditches (edges and non-flooded portions); lakes (edges and non-flooded portions); ponds (edges and non-flooded portions)	diquat	Delay using treated water as follows: for drinking – 3 days; for livestock consumption – 1 day; for filling agricultural spray tanks for, and for irrigation to turf and ornamentals – 3 days; for filling agricultural spray tanks for, and for irrigation to food crops – 5 days. In flowing water do not apply within 1,600 feet upstream or within 400 feet downstream of operating potable water intake sites. In flowing water do not apply within 1,400 feet for rates at 2.0 gal per acre, or within 700 feet for rates at 1.0 gal per acre, or within 350 feet for rates equal to or less than 0.5 gal per acre, of potable water intake sites.

Table 2. Herbicides Labeled For Hydrilla Management with Application Sites, Active Ingredients and Use Precautions.

Herbicide Trade Name	Application Sites	Active Ingredient	Use Precautions
Sonar A.S.	drainage canals; irrigation canals; lakes; ponds (fresh water); potable water sources; reservoirs	fluridone	Delay irrigation from ponds of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 30 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 30 days. Delay irrigation from canals of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 14 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 30 days. Delay irrigation from lakes and reservoirs of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 14 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 14 days. Do not apply at rates greater than 20 ppbw within 1/4 mile of a functioning potable water intake.

Table 2. Herbicides Labeled For Hydrilla Management with Application Sites, Active Ingredients and Use Precautions.

Herbicide Trade Name	Application Sites	Active Ingredient	Use Precautions
Sonar SRP	drainage canals; irrigation canals; lakes; ponds (fresh water); potable water sources; reservoirs; rivers	fluridone	Delay irrigation from ponds and static canals of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 30 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 30 days. Delay irrigation from canals of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 7 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 30 days. Delay irrigation from rivers of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 7 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 7 days. Delay irrigation from lakes and reservoirs of the following crops for the indicated period: Established tree crops – 7 days; established row crops, turf, and plants – 7 days; newly seeded crops, seedbeds, or areas to be planted (including overseeded greens) – 7 days. Do not apply at rates greater than 20 ppbw within 1/4 mile of a functioning potable water intake. Do not apply at rates greater than 20 ppbw within 1/4 mile of a functioning potable water intake.