



Applying Herbicides Effectively in an Aquatic Interface

Levi Blackmon

ACES - Aquatic Resources Agent - South Alabama

PowerPoint Support by Norm Haley & Kerry Steedley – Extension Agent's

Water hyacinth

Eichhornia crassipes

Photo by Karen Brown

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Understanding Invasive and Weed Species

- Hub & Spoke Effect
 - Hubs – invasive species with high dispersal ability, competitive, tolerance, and predatory traits.
 - Spokes – other species often connected to the hub that can be impacted
 - Driving Mechanisms – Anthropogenic effect (transport), no natural controls, habitat structure change



Why Invasive Species Matter

Definition of Invasive Species

Non-native organisms that cause harm by spreading rapidly and outcompeting native species in new ecosystems.

Characteristics of Invasive Species

High reproductive rates, broad environmental tolerance, rapid growth, and lack of natural predators enable dominance.

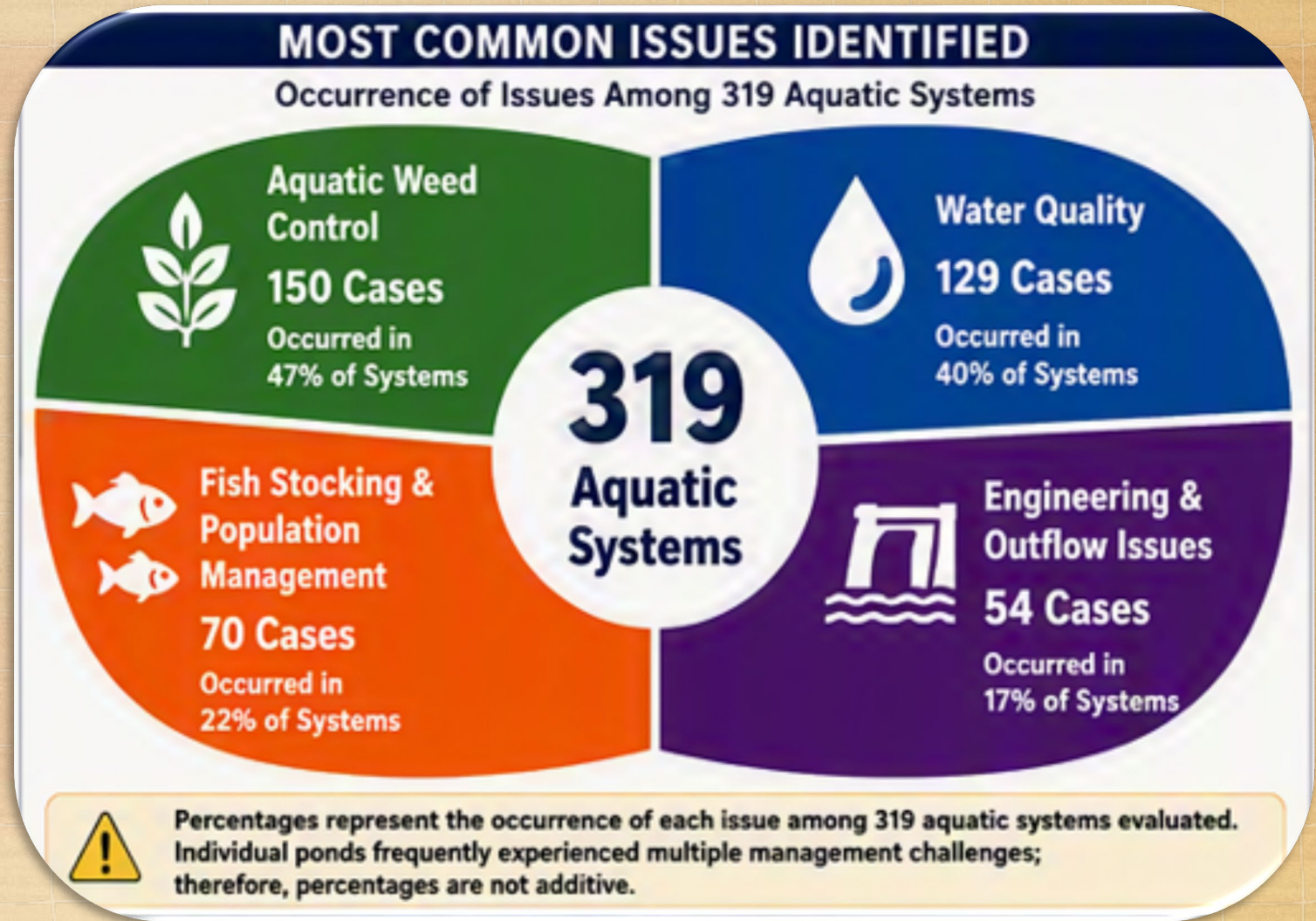
Ecological and Economic Impact in Alabama

Invasive species disrupt ecosystems, damage agriculture, and pose health risks, costing Alabama millions annually.

Importance of Awareness and Management

Understanding invasive species supports prevention, recognition, and control efforts crucial for ecosystem health.

Impacts of Aquatic Weeds in South Alabama



Alabama's Vulnerability to Invasions

No.1 in freshwater biodiversity – > 815 species

Over 132,000 miles of streams & rivers

563K acres of ponds, lakes & reservoirs

3.6 million acres of wetlands & marshes



Climate, Geography, and Pathways of Introduction

Favorable Climate for Invasives

Alabama's warm temperatures and long growing seasons allow invasive species to reproduce year-round.

Geographical Pathways

Ports, rivers, agricultural lands, and urban areas provide major pathways for invasive species introduction and spread.

Human Activity Impact

Ornamental plants, boating, agriculture, and forestry activities contribute to invasive species spread in Alabama.

Ecological and Climate Risks

High biodiversity and climate change increase risks and consequences of invasive species impacts.



Aquatic Invasive Species

Alabama Invasive Aquatic Plants

Alabama Invasive Plant Council (ALIPC) & Alabama Department of Conservation & Natural Resources (ADCNR)

common salvinia
hydrilla
water hyacinth
alligatorweed
Cuban bulrush
giant salvinia
Lyngbya wollei
dotted duckweed
Eurasian milfoil
parrotfeather
brittle waternymph
common reed
Uruguayan waterprimrose
water lettuce

Alabama Regulation 220-2-.124: Alabama Nonindigenous Aquatic Plant Control Act

For the purposes of enforcement of Sections 9-20-1 through 9-20-7, Code of Alabama 1975, enacted by Act No. 95-767, as the "Alabama Nonindigenous Aquatic Plant Control Act," the following list of all nonindigenous aquatic plants which are prohibited by Section 9-20-3 from being introduced or placed or caused to be introduced or placed into public waters of the state is established:

African elodea, alligatorweed, Brazilian elodea, curlyleaf pondweed, Eurasian watermilfoil, floating waterhyacinth, giant salvinia, hydrilla, hygrophila, limnophila, parrot-feather, purple loosestrife, rooted waterhyacinth, spinyleaf naiad, water-aloe, water lettuce, water chestnut, and water spinach

Aquatic plants that are illegal under federal law as of June 30, 2006, include: mosquito fern or water velvet (*Azolla pinnata*), Mediterranean clone of caulerpa (*Caulerpa taxifolia*), anchored waterhyacinth (*Eichornia azurea*), hydrilla (*Hydrilla verticillato*), Miramar weed (*Hygrophila polysperma*), water-spinach (*Ipomoea aquatica*), *Lagarosiphon major*, *ambulia* (*Limnophila sessiliflora*), *Melaleuca quinquenervia*, *Monochoria hastata*, *Ottelia alismoides*, arrowhead (*Sagittaria sagittifolia*), giant Salvina (*Salvinia auriculata*, *S. biloba*, *S. herzogii*, and *S. molesta*), wetland nightshade (*Solanum tampicense*), exotic bur-reed (*Sparganium erectum*).

~Alabama Aquatic Nuisance Species Management Plan~

Alabama Aquatic Nuisance Species Management Plan Flora

Aquatic Plants	Common Name	Scientific Name	Approach			
			Objective 1: Coordination of Activities and Programs	Objective 2: Prevention, Control, and Manage Through Education	Objective 3: Actively Control and Manage	Objective 4: Prevent Through Legislation, Regulation, and Enforcement
2.9	Common Salvinia	<i>Salvinia minima</i>	MEDIUM	HIGH	HIGH	LOW
2.9	Hydrilla	<i>Hydrilla verticillata</i>	MEDIUM	HIGH	HIGH	LOW
2.8	Water Hyacinth	<i>Eichhornia crassipes</i>	MEDIUM	HIGH	HIGH	LOW
2.6	Alligatorweed	<i>Alternanthera philoxeroides</i>	MEDIUM	LOW	HIGH	LOW
2.5	Cuban Bulrush	<i>Cyperus blepharoleptos</i>	MEDIUM	MEDIUM	HIGH	LOW
2.5	Giant Salvinia	<i>Salvinia molesta</i>	MEDIUM	HIGH	HIGH	LOW
2.4	Blue-Green Algae	<i>Lyngbya wollei</i>	MEDIUM	HIGH	HIGH	LOW
2.3	Dotted Duckweed	<i>Landoltia punctata</i>	MEDIUM	HIGH	LOW	LOW
2.3	Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>	MEDIUM	HIGH	HIGH	LOW
2.3	Parrotfeather	<i>Myriophyllum aquaticum</i>	LOW	HIGH	LOW	LOW
2.1	Brittle Waterlily	<i>Najas minor</i>	MEDIUM	HIGH	MEDIUM	LOW
2.1	Common Reed	<i>Phragmites australis</i>	LOW	LOW	MEDIUM	LOW
2.1	Uruguayan Waterprimrose	<i>Ludwigia uruguayensis</i>	MEDIUM	LOW	HIGH	LOW
2.1	Water Lettuce	<i>Pistia stratiotes</i>	MEDIUM	HIGH	HIGH	LOW

Torpedograss

Scientific Name: *Panicum repens*

Family: Poaceae

Native: Tropical to sub-tropical regions of Africa & Eurasia

Habit

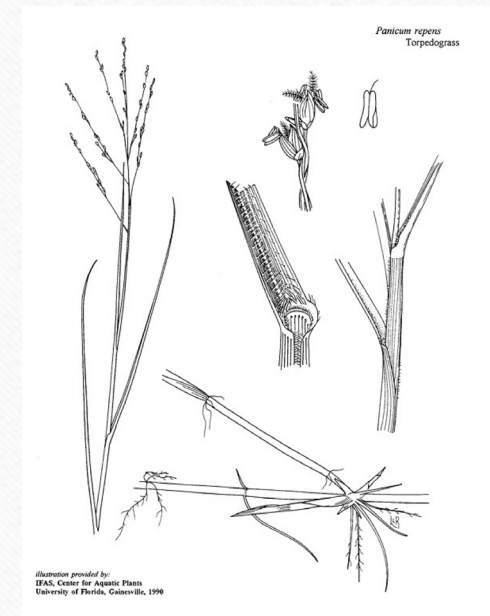
- perennial rhizomatous creeping grass capable of forming dense monocultures. Perennial grass growing up to 3 feet tall
- Long creeping rhizomes tipped with sharp, torpedo-like points
- Rigid aerial stems produced from underground rhizomes

Reproduction

- Predominantly vegetative propagation via stolon and rhizome fragments
- Rhizome node and stem fragment capable of producing new plants, making attempted control by mowing and other mechanical disturbance a risk factor for spread
- Sexual reproduction (via seeds) limited; overall reproductive success low
- Flowers throughout summer and into early fall (May to November)

Leaves

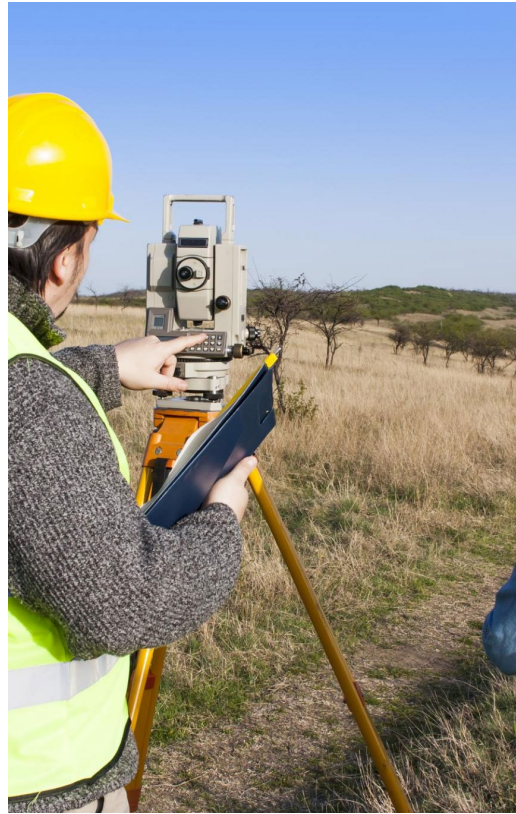
- Linear, flat, or folded, typically 1 inch to 10 inches long and 0.04 inches to 0.25 inches wide, often with a waxy or whitish coating
- Sheaths glabrous or hairy; ligule membranous with short hairs





Management and Control Methods

Flora



Early Detection and Rapid Response Strategies

Importance of Early Detection

Early detection identifies invasive species quickly to prevent widespread establishment and damage.

Role of Public Involvement

Public participation helps detect unusual species as landowners and outdoor enthusiasts report sightings.

Rapid Response Actions

Rapid response includes targeted removal, quarantines, and closures to control invasive spread quickly.

Collaboration and Outreach

Partnerships between agencies and education improve communication, funding, and response effectiveness.

Plant Identification

- **Accurate Plant Identification is Key**
 - Chemicals, rates, and applications are species dependent and site specific
 - Some pond uses, sites, water flow, water chemistries, and uses limit mgt. options
 - Often, more than one species is present
 - Time and money can be saved by selecting products/mixes that treat both issues simultaneously

**Misidentification or guessing can
cost you significant money and headache**

Free-floating plants



Algae



Southern Naiad



Submerged Plants

Bladderwort



Invasive

Eurasian watermilfoil



Emergent Plants

Invasive
Alligatorweed



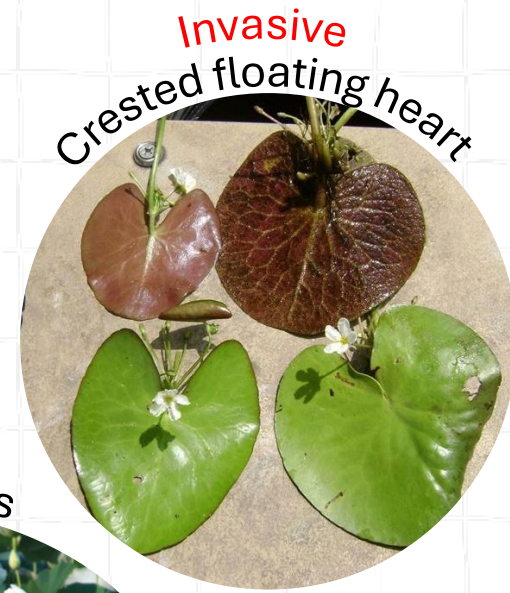
Invasive
parrotfeather



Invasive
Wild taro



Floating-leaved Plants AKA: emergent



Chemical Control



Why use aquatic herbicides?



Before



After

- Control threshold beyond other control measures
- Treatment of submerged vegetation
- Treatment of floating or emergent vegetation
- Treatment of shoreline species
- Chance of impact on surface water or groundwater

Toxicity – Aquatic Life

- Quick calculation: Rodeo vs. Bluegill
 - 5.4 lb/gal of glyphosate
 - 1 acre pond with 4 acre/ft volume
 - $68 \text{ lb} \times 4 \text{ acre/ft} = 272 \text{ lb}$
 - $272 \text{ lb} / 5.4 \text{ lb} = 50.3 \text{ gallons}$

You would have to apply 50 gallons of Rodeo to pond to kill 50% in 4 days

Aquatic Herbicide Toxicity to Some Fish						
The 96-hour LC ₅₀ is given in ppm columns. The lb column gives the pounds of active ingredient needed per acre*ft to reach the 96-hour LC ₅₀						
Herbicide	Bluegill		Channel Catfish		Rainbow Trout	
	ppm	lb	ppm	lb	ppm	lb
Endothall (Aquathol)	343	933	150	408	230	625.6
Endothall (Hydrothol)	1.0	2.72	0.5	1.4	1.7	4.6
Copper	Toxicity dependent upon alkalinity of water. The lower the alkalinity, the greater the toxicity.					
Diquat	14	38			15	41
Rotenone (a fish toxicant)	0.02	0.05	0.002	0.005	0.03	0.08
Glyphosate	25	68	13	35	28	76
2,4-D (Amine) Weedar 64, Weed Rhap A-4D, DMA 4 IVM	263	715	166	452	222	604
2,4-D (Ester) Navigate, Aqua-Kleen	2	5.4	1	2.7	1	2.7
Imazapyr	336	914	>100	>272	>100	>272
Triclopyr	681	1,852	446	1,213	400	1,088
Imazamox	119	324			122	332
Carfentrazone	2.0	5.4			16	44
Penoxsulam	103	280			102	277
Sodium Carbonate Peroxyhydrate	26(*a)	71(*b)	24(*a)	65(*b)	22(*a)	60(*b)
Flumioxazin	21	111.3			2.3	12.2
Florpyrauxifen	Practically non-toxic to fish at normal use rates.(LC50 > 100ppm)					
Bispyribac-sodium	>100	272			>100	>272
Topramezone					>100	>272

-The 96-hour LC₅₀ is the amount of material needed to kill 50% of a population within 96 hours.
 -ppm values are for the amount of active ingredient.
 (*a) - Toxicity as ppm Hydrogen Peroxide.
 (*b) - Expressed as pounds Hydrogen Peroxide. User will need to calculate the amount of product this equals from label information.

Applying herbicides – 300 registered in US

Contact Herbicides	Systemic Herbicides
Copper and Copper products	2,4-D
Diquat*	Glyphosate
Endothall*	Fluridone
Carfentrazone	Triclopyr
Sodium Carbonate Peroxyhydrate	Imazapyr
Flumioxazin	Imazamox
	Penoxsulam
	Bispyribac Sodium
	Topramezone
	Florpyrauxifen

Safe Mixing, Loading, Application – Personal Protective Equipment (PPE)

Personal Protective Equipment:

Some of the materials that are chemical-resistant to this product are polyethylene or polyvinyl chloride. If you want more options, follow the instructions for Category A on an EPA chemical-resistance category selection chart.

All mixers, loaders, applicators, flaggers, and other handlers must wear:

- Coveralls over shortsleeved shirt and short pants.
- Chemical-resistant gloves when applying with any handheld nozzle or equipment, mixing or loading, cleaning up spills or equipment, or otherwise exposed to the concentrate.
- Chemical-resistant footwear and socks.
- Protective eyewear.
- Chemical-resistant headgear for overhead exposure.
- Chemical-resistant apron when mixing or loading, cleaning up spills or equipment, or otherwise exposed to the concentrate.



The Label Will Answer Many Common Questions...

- Can this be put in a pond or around water?
 - Surface water
 - Aquatic plant control section
- How much should I mix/apply?
- Post Application Restrictions
 - Will it hurt my fish?
 - Can I swim?
 - Will it hurt my livestock?
 - Can I irrigate?
- Personal Safety Equipment Requirements

 ALLIGARE

FLUMIGARD™
Herbicide

SPECIMEN LABEL

FOR USE IN CONTAINER AND FIELD GROWN CONIFERS (INCLUDING CHRISTMAS TREES) AND DECIDUOUS TREES, AROUND ESTABLISHED WOODY ORNAMENTALS IN LANDSCAPES, TO MAINTAIN BARE GROUND NON-CROP AREAS, CONIFER AND POPLAR REFORESTATION SITES, AND DORMANT TURFGRASS, FOR THE MANAGEMENT OF UNDESIRABLE AQUATIC VEGETATION IN SLOW MOVING OR QUIESCENT WATERS (TO CONTROL FLOATING AND EMERGED WEEDS USING SURFACE AND SUBSURFACE APPLICATIONS)

*Not approved for use in conifer and poplar re-forestation sites in California.

ACTIVE INGREDIENT:	By Wt.
Flumioxazin	51.0%
OTHER INGREDIENTS:	49.0%
TOTAL:	100.0%
*12 (7-fluoro-3,4-dihydro-5-oxo-4H-pyridin-2-yl)-1,4-benzoxazin-6-yl 4,5,6,7-tetrahydro-1H-isoxazole-1,3(2H)-dione	

Alligare FLUMIGARD™ Herbicide is a water dispersible granule containing 51% active ingredient.

EPA Reg. No. 81027-08

KEEP OUT OF REACH OF CHILDREN
CAUTION

FIRST AID	
If inhaled:	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. • Call a poison control center or doctor for further treatment advice.
If on skin or clothing:	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15 to 20 minutes. • Call a poison control center or doctor for treatment advice.
If in eyes:	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. • Call a poison control center or doctor for treatment advice.
If swallowed:	• Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to an unconscious person.

HOT LINE NUMBER
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-424-9300 for emergency medical treatment information.

Manufactured for:
Alligare, LLC
13 N. 8th Street
Opelika, AL 36801

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION: Harmful if inhaled or absorbed through the skin. Causes moderate eye irritation. Avoid breathing dust and spray mist. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco. Remove and wash contaminated clothing before reuse.

PERSONAL PROTECTIVE EQUIPMENT (PPE)
Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Waterproof gloves
- Shoes and socks

USER SAFETY REQUIREMENTS
Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS
Users should:

- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

FLUMIOXAZIN GROUP 14 HERBICIDE

Terrestrial Uses
This product is toxic to non-target plants and aquatic invertebrates. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high-water mark. Drift and runoff may be hazardous to non-target plants and aquatic organisms in neighboring areas. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from treated areas. Do not contaminate water when disposing of equipment washwaters or rinsate.

ENVIRONMENTAL HAZARDS
This pesticide is toxic to plants and must be used strictly in accordance with the drift and run-off precautions on this label in order to minimize off-site exposures.
Under some conditions this product may have a potential to run off to surface water or adjacent land. Where possible, use methods which reduce soil erosion, including no-till, limited till and contour plowing; these methods also reduce pesticide run-off. Use of vegetation filter strips along rivers, creeks, streams, wetlands or on the downwind side of fields where run-off could occur will minimize water run-off.

Aquatic Uses
If not used in accordance with directions on the label, this product can be toxic to non-target plants and aquatic invertebrates. Do not apply to water except as specified on the label. Drift and runoff may be hazardous to non-target plants and aquatic organisms in neighboring areas. If not used in accordance to label directions. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from treated areas. Do not contaminate water when disposing of equipment washwaters.

DIRECTIONS FOR USE
It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
READ ENTIRE LABEL. USE STRICTLY IN ACCORDANCE WITH PRECAUTIONARY STATEMENTS AND DIRECTIONS, AND WITH APPLICABLE STATE AND FEDERAL REGULATIONS.
Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

AGRICULTURAL USE REQUIREMENTS
Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. The Standard contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific statements on the label about personal protective equipment (PPE), and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.
Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours.
PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, including plants, soil, or water, is:

- Coveralls
- Waterproof gloves
- Shoes plus socks

NON-AGRICULTURAL USE REQUIREMENTS
The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.
Keep all unprotected persons out of operating areas, or vicinity where there may be drift. Do not enter or allow others to enter treated areas until sprays have dried.

TANK MIXES
NOTICE: Tank mixing or use of this product with any other product which is not specifically and expressly authorized by the label shall be the exclusive risk of user, applicator and/or application advisor, to the extent allowed by applicable law. It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

PRODUCT INFORMATION
Terrestrial Uses
Alligare FLUMIGARD Herbicide is a preemergence and early postemergence herbicide for control of selected grass and broadleaf weeds in and around ornamental woody shrubs, deciduous trees and conifers (including Christmas trees) grown outdoors in containers or in the field (in ground), to maintain bare ground non-crop areas, conifer and poplar re-forestation and dormant warm season turfgrass.
Alligare FLUMIGARD Herbicide controls weeds by inhibiting protoporphyrinogen oxidase, an essential enzyme required by plants for chlorophyll biosynthesis. Seedling weeds are controlled preemergence when exposed to sunlight following contact with the soil applied herbicide.
Alligare FLUMIGARD Herbicide may cause spotting or speckling on foliage if the spray solution directly contacts actively growing plant foliage or green bark. Leaves that receive

Specimen Label

GLYPHOSATE GROUP 9 HERBICIDE



Rodeo®

HERBICIDE

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For control of annual and perennial weeds and woody plants in natural and production (plantations), forests for site preparation, mid-rotation release treatments, timber stand improvement activities, noncrop sites including industrial sites, rights-of-way (including roadsides, electric utility and communication transmission lines, pipelines, railroads, airports), irrigation and drainage ditches, canals, reservoirs, natural areas (including wildlife management areas, wildlife openings, wildlife habitats and refuges, parks and recreation areas, campgrounds, trainroads and trails), rangeland, and in and around aquatic sites and wetlands also for perennial grasses and grazed areas on these sites.

Avoid contact of herbicide with foliage, green stems, exposed non-woody roots or fruit of crops, desirable plants and trees, because severe injury or destruction may result.

Active Ingredient:
glyphosate† N-(phosphonomethyl)glycine, 53.8%
isopropylamine salt 46.2%
Other Ingredients 100.0%
Total 100.0%

†Contains 5.4 lb per gallon glyphosate, isopropylamine salt (4 lb per gallon glyphosate acid).

Precautionary Statements

Hazards to Humans and Domestic Animals

EPA Reg. No. 62719-324

Keep Out of Reach of Children

CAUTION

Harmful If Inhaled • Avoid breathing spray mist. Remove contaminated clothing and wash before reuse. Wash thoroughly with soap and water after handling.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Controls

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in Worker Protection

Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

First Aid

If inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-992-5994 for emergency medical treatment information.

Environmental Hazards

Do not contaminate water when cleaning equipment or disposing of equipment washwaters. Treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants. This oxygen loss can cause fish suffocation.

In case of leak or spill, soak up and remove to a landfill.

Physical or Chemical Hazards

Spray solutions of this product should be mixed, stored and applied using only stainless steel, aluminum, fiberglass, plastic or plastic-lined steel containers.

Do not mix, store or apply this product or spray solutions of this product in galvanized steel or unlined steel (except stainless steel) containers or spray tanks. This product or spray solutions of this product react with such containers and tanks to produce hydrogen gas, which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

Directions for Use

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Read all Directions for Use carefully before applying.

This is an end-use product. Dow AgroSciences does not intend and has not registered it for reformulation.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your state or tribe, consult the agency responsible for pesticide regulation.

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE), and restricted entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 4 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

- Coveralls
- Chemical-resistant gloves made of any waterproof material
- Shoes plus socks

Non-Agricultural Use Requirements

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries or greenhouses.

Keep people and pets off treated areas until spray solution has dried.

Environmental Hazards

Do not contaminate water when cleaning equipment or disposing of equipment washwaters. Treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants. This oxygen loss can cause fish suffocation.

In case of leak or spill, soak up and remove to a landfill.

CAUTION

Harmful If Inhaled • Avoid breathing spray mist. Remove contaminated clothing and wash before reuse. Wash thoroughly with soap and water after handling.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Adjust wiper applicators used over the top of desirable vegetation so that the wiper contact point is at least 2 inches above the desirable vegetation. Better results are obtained when more of the weed is exposed to the herbicide solution. Weeds should be a minimum of 6 inches above the desirable vegetation. Adjust the applicator height to ensure adequate contact with weeds as weeds not contacted by the herbicide solution will not be affected. Poor contact may occur when weeds are growing in dense clumps, in severe weed infestations, or when weed height varies dramatically. If this occurs, repeat treatment up to the labeled rate may be necessary.

Operate this equipment at ground speeds no more than 5 mph. Performance may be improved by reducing speed in areas of heavy weed infestations to ensure adequate wiper saturation. Better results may be obtained if two applications are made in opposite directions.

Droplets, mist, foam, or splatter of the herbicide settling onto desirable vegetation may result in discoloration, stunting or destruction. Avoid leakage or dripping onto desirable vegetation. Adjust height of applicator to ensure adequate contact with weeds. Keep wiping surfaces clean. Be aware that on sloping ground the herbicide solution may migrate, causing dripping on the lower end and drying of the wicks on the upper end of a wiper applicator.

Do not use wiper equipment when weeds are wet.

Mix only the amount of solution to be used during a one-day period as reduced activity may result from use of leftover solutions. Clean wiper parts by thoroughly flushing with water immediately after using this product.

For best results, use a nonionic surfactant at a rate of 10 percent by volume of total herbicide solution for all wiper applications. **Rope or Sponge Wick Applicators:** Use solutions of 33 to 75 percent of this product in water.

Panel Applicator: Use solutions of 33 to 100 percent of this product in water.

Injection Systems

Equipment: Aerial or ground injection sprayers.

This product may be used in aerial or ground injection spray systems. It may be used as a liquid concentrate or diluted prior to injecting into the spray stream. Do not mix this product with the concentrate of other products when using injection systems.

Controlled Droplet Applicator (CDA)

Equipment: Hand-held or boom-mounted applicators that produce a spray consisting of a narrow range of droplet sizes.

The rate of this product applied per acre by vehicle-mounted CDA equipment must not be less than the amount specified on this label when applied by conventional broadcast equipment. For vehicle-mounted CDA equipment, apply 3 to 15 gallons of water per acre.

For the control of annual weeds with hand-held CDA units, apply a 20 percent solution of this product at a flow rate of 2 fl oz per minute and a walking speed of 1.5 mph (1 1/2 pints of product per acre). For control of perennial weeds, apply a 20 to 40 percent solution of this product at a flow rate of 2 fl oz per minute and a walking speed of 0.75 mph (3 to 6 pints of product per acre).

CDA equipment produces a spray pattern that is not easily visible. Exercise extreme care to avoid spray or drift contacting the foliage or any other green tissue of desirable vegetation as damage or destruction may result.

Use Sites

Use this product in noncrop areas, including airports, apartment complexes, aquatic sites, Christmas tree farms, commercial sites, Conservation Reserve Program (CRP) areas, ditch banks, driveways, dry ditches, dry canals, fencerows, golf courses, greenhouses, habitat management, industrial areas, lumber yards, manufacturing sites, municipal sites, natural areas, office complexes, ornamentals, parking areas, parks, pastures, petroleum tank farms and pumping installations, plant nurseries, public areas, railroads, rangeland, recreation areas, utility rights-of-way, roadsides, shadehouses, sod or turf seed farms, sports complexes, storage areas, substations, turfgrass areas, utility sites, warehouse areas, wildlife habitat management areas, and in grazed areas.

Aquatic Sites

This product may be applied to emerged weeds in all bodies of fresh and brackish water that may be flowing, nonflowing or transient including lakes, rivers, streams, ponds, estuaries, rice levees, seeps, irrigation and drainage ditches, canals, reservoirs, wastewater treatment facilities, wildlife habitat restoration and management areas and similar sites.

If aquatic sites are present in the noncrop area and are part of the intended treatment, read and observe the following directions:

- This product does not control plants that are completely submerged or have a majority of their foliage under water.
- There is no restriction on the use of treated water for irrigation, recreation or domestic purposes.
- Consult local and state fish and game agency and water control authorities before applying this product to public water. Permits may be required to treat such water.
- To make aquatic applications around and within 1/2 mile of active potable water intakes, the water intake must be turned off for a minimum period of 48 hours after the application. The water intake may be turned on prior to 48 hours if the glyphosate level in the intake water is below 0.7 parts per million as determined by laboratory analysis. These aquatic applications may be made **only** in those cases where there are alternative water sources or holding ponds which would permit the turning off of an active potable water intake for a minimum period of 48 hours after the application.
- For treatments after draw down of water or in dry ditches, allow 7 days or more after treatment before reintroduction of water to achieve maximum weed control. Apply this product within 1 day after draw down to ensure application to actively growing weeds.
- Floating mats of vegetation may require retreatment up to the labeled rate. Avoid wash off of sprayed foliage by spray boat or recreational boat backwash or by rainfall within 6 hours of application. Do not retreat within 24 hours following the initial treatment.

- Applications made to moving bodies of water must be made while traveling upstream to prevent concentration of this herbicide in water. When making any bankside applications, do not overlap more than 1 foot into open water. Do not spray in bodies of water where weeds do not exist. The maximum application rate of 7 1/2 pints per acre must not be exceeded in any single broadcast application that is being made over water.
- When emerged infestations require treatment of the total surface area of impounded water, treating the area in strips may avoid oxygen depletion due to decaying vegetation. Oxygen depletion may result in fish kill.

Restrictions:

- Do not apply this product directly to water within 1/2 mile upstream of an active potable water intake in flowing water (i.e., river, stream, etc.), or within 1/2 mile of an active potable water intake in a standing body of water, such as a lake, pond or reservoir. This restriction does not apply to intermittent inadvertent overspray of water in terrestrial use sites.

Wetland Sites

This product may be applied to undesirable vegetation in and around water (aquatic areas) and wetlands found in forestry, utility rights-of-way sites or other site listed on the label, including where these sites are adjacent to or surrounding domestic water supply reservoirs, supply streams, lakes and ponds.

If wetland sites are present, read and observe the following directions:

- There is no restriction on the use of treated water for irrigation, recreation or domestic purposes.
- Consult local public water control authorities before applying this product in and around public water. Permits may be required to treat in such areas.

Restrictions:

- Do not apply this product directly to water within 1/2 mile upstream of an active potable water intake in flowing water (i.e., river, stream, etc.), or within 1/2 mile of an active potable water intake in a standing body of water, such as a lake, pond or reservoir. This restriction does not apply to intermittent inadvertent overspray of water in terrestrial use sites.
- Do not spray open bodies of water where woody brush, trees and herbaceous weeds do not exist. Do not apply more than 3 3/4 quarts per acre in a single over water broadcast application except in stream crossings in utility right-of-way or where applications will result in less than 20 percent of the total water area being treated. In either of these locations, any specified rate may be applied.

Christmas Tree Plantations

Broadcast Application (Oregon and Washington Only)

Broadcast apply this product over the established Christmas tree species Douglas fir (*Pseudotsuga menziesii*), fir species (*Abies* spp.), and pine species (*Pinus* spp.) (except eastern white, loblolly, longleaf, shortleaf, slash), and spruce species (*Picea* spp.). Use 1 quart of this product per acre in 5 to 30 gallons of water per acre. For best results, add up to 10 fl oz of Entry II surfactant per acre. If using a different surfactant, follow the manufacturer's directions for use and ensure conifer safety has been adequately tested for that surfactant. Apply after trees have completed at least a full growing season since planting or transplanting.

- This product does not control plants that are completely submerged or have a majority of their foliage under water.
- There is no restriction on the use of treated water for irrigation, recreation or domestic purposes.

- Applications made to moving bodies of water must be made while traveling upstream to prevent concentration of this herbicide in water. When making any bankside applications, do not overlap more than 1 foot into open water. Do not spray in bodies of water where weeds do not exist. The maximum application rate of 7 1/2 pints per acre must not be exceeded in any single broadcast application that is being made over water.
- When emerged infestations require treatment of the total surface area of impounded water, treating the area in strips may avoid oxygen depletion due to decaying vegetation. Oxygen depletion may result in fish kill.

Restrictions:

- Do not apply this product directly to water within 1/2 mile upstream of an active potable water intake in flowing water (i.e., river, stream, etc.), or within 1/2 mile of an active potable water intake in a standing body of water, such as a lake, pond or reservoir. This restriction does not apply to intermittent inadvertent overspray of water in terrestrial use sites.

Use Restrictions

Table 2. Aquatic vegetation herbicide control water use restriction (number of days after treatment before use in private waters only).¹

Common name	Human use			Livestock	Irrigation	
	Drinking	Swimming	Fish	Watering	Turf	Crops
bispyribac	0	0	0	0	30	30
carfentrazone	0 - 1 ²	0	0	0 - 1 ²	0 - 14 ²	0 - 14 ²
copper complexes ³	0	0	0	0	0	0
diquat	1 - 3 ⁴	0	0	1	1 - 3 ⁴	5
endothall ⁵	7 - 25	1	0	7 - 25	7 - 25	7 - 25
flumioxazin	0	0	0	0	0 - 3 ⁴	5
fluridone ⁶	0	0	0	0	7 - 30	7 - 30
glyphosate ⁷	0	0	0	0	0	0
imazamox	0	0	0	0	1	1 ⁸
imazapyr	*9	0	0	0	120 ¹⁰	120 ¹⁰
penoxsulam	0	0	0	0	0	*11
SCP ¹²	0	0	0	0	0	0
triclopyr	*13	0	0	0	0 ¹⁴	120 ¹⁵
2,4-D	*16	*16	*16	*16	*16	*16

¹ Aquatic vegetation control can cause a period of low dissolved oxygen, which can stress and/or kill fish. It is best to treat most aquatic vegetation early in the growing season when the plant is rapidly growing. Treating small areas (e.g., ¼) of pond at a time at 10- to 14-day intervals usually will allow for decomposition without causing an oxygen depletion.

² Varies if 20% or more of surface area is treated.

³ If water is for drinking, the elemental copper concentration should not exceed 1.0 ppm (i.e., 4.0 pp. copper sulfate).

⁴ Depending on formulation or rate. **Read label.**

⁵ Length of use restriction for endothall varies with concentration used. **Read label.**

⁶ Do not apply within ¼ mile of a functioning potable water intake.

⁷ Do not apply within ½ mile of a functioning potable water intake.

⁸ Do not use treated water to irrigate greenhouses, nurseries or hydroponics.

⁹ Greater than ½ mile from potable water intake.

¹⁰ Or until <1.0 ppb.

¹¹ Do not use water from any treated site for food crop irrigation until residues are determined to be less than or equal to 1 ppb.

¹² Sodium carbonate peroxyhydrate.

¹³ Minimum setback distances from potable water intakes required and laboratory tests to determine < 0.4 ppm. **Read label.**

¹⁴ No restriction on irrigating established grasses but do not harvest hay for 14 days after application. **Read label.**

¹⁵ Or until non-detectable concentration in immunoassay analysis.

¹⁶ Water restrictions on 2,4-D vary with formulation, location, rate and time of year. **Read label.**

WEED RESPONSE RATINGS FOR AQUATIC HERBICIDES¹

Aquatic Weed Group	Copper Sulfate and Copper Complexes	2,4-D	Diquat	Endothal	Fluridone	Glyphosate	Triclopyr	Imazapyr	Imazamox	Carfentrazone	Penoxulam	Sodium Carbonate Peroxyhydrate	Flumioxazin	Bispyribac Sodium	Topramezone	Florpyrauxifen	Grass Carp
Algae																	
Planktonic	E	P	P	G	P	P	P	P				G-E					
Filamentous	E ²	P	G	P-G ³	P	P	P	P				G-E	G-E				F-P
Chara	E	P	P-G	P-G ³	P	P	P	P									E
Nitella	E	P	P-G	P-G ³	P	P	P	P									G
Free Floating Weeds																	
Bladderwort	P	P-G ⁴	E	F	G			G-E			G		G		G		E-G
Duckweed	P	F	G	P	E			G		G-E	E		E	E			P-F
Watermeal	P	P	F		G	P	P	P		G	G		E	E			
Azolla	P	F	G		G-E	F				E	E		E	E		G-E	P-F
Water hyacinth	P	E	E		P	F	E	E	E	G-E	E			E	E	G-E	P
Rooted Floating Weeds																	
American lotus	P	E	P	P	F	G	E	G	G						G	G-E	P
Water lily (fragrant and white)	P	E	P	P	E	E	E	E	G								P
Spatterdock	P	E	P	P	E	G		G									P
Watershield	P	E	P		G	G		E	G	G						G-E	F-P
Emerald Weeds																	
Alligator weed	P	F	P	P	G	E	E	E	G	G	G		E	E		G-E	P
Arrowhead	P	E	G	G		P		E	E		G				E		F-P
Buttonbush	P	E	F	P	P	G	G	G									
Cattails	P	G	G	P	F	E	P	E	E								
Common reed	P	F	F	P	F	E	G	E									
Ducksalad	P	E	G	P		E		E	G-E								P
Frogbit	P	E	E					E	E	G	E		E				P
Maidencane	P	P	F		F	E	P	E									F-P
Pickeralweed	P	G	G			P	E	E	E		G						P
Pond edge annuals	P		G		E	E		E									
Sedges and rushes	P	F	F	P		G	P	E									P
Slender spikerush	P		G		G	P	P	E			G					G-E	
Smartweed	P	G	F		F	E	E	E	E		G						P
Water pennywort	P	G	G	P	P	G	E	E			E		E	E		G-E	F-P
Water primrose	P	E	F-G		F	E	E	E	E	G			G-E			G-E	P
Willows	P	E	F	P	P	E	E	E									

¹ E = excellent control, G = good control, F = fair control, P = poor control.

² For Pithophora, only F-G control.

³ Hydrothol formulation only.

⁴ Granular 2,4-D formulation.

⁵ Copper complexes only (ex. Komeen, Captain, K-Tea).

(Continued on page 149)

WEED RESPONSE RATINGS FOR AQUATIC HERBICIDES¹ [cont.]

Aquatic Weed Group	Copper Sulfate and Copper Complexes	2,4-D	Diquat	Endothal	Fluridone	Glyphosate	Triclopyr	Imazapyr	Imazamox	Carfentrazone	Penoxsulam	Sodium Carbonate Peroxyhydrate	Flumioxazin	Bispyribac Sodium	Topramezone	Florpyrauxifen	Grass Carp
Submersed Weeds																	
Coontail	P	G	E	E	E	P							E			G-E	G-F
Egeria	P-G ⁵	P	G	G	E	P		P			E						E
Elodea	P-G ⁵	G	E	F	E	P		P			E		E				E
Fanwort	P	F	G	E	E	P		P					E				E
Hydrilla	P-E ⁵	P	G	G	E	P		P	G		E		E	E	E	E	E
Naiads	P	F	E	E	E	P		P			G		E		G		E
Parrotfeather	P	E	E	E	E	F	F	G (when emerged)	G	E	G		E	E		G-E	F-P
Pondweeds	P-G ⁵	P	G	E	E	P		F	E		E		E	E	E		G-P
Water milfoil (broadleaf)	P		E	E	E	P	G	P	G	G	E						P
Water milfoil (Eurasian)	P	E	E	E	E	P	G	P	G	G-E	E		E	E	G		F-P

¹ E = excellent control, G = good control, F = fair control, P = poor control.

² For Pithophora, only F-G control.

³ Hydrothol formulation only.

⁴ Granular 2,4-D formulation.

⁵ Copper complexes only (ex. Komeen, Captain, K-Tea).



Surfactants

- (Cygnet Plus, Cide-Kick, Kammo Plus, Liberate, Trace, Preference, Optima, Aquasticker) Sticker, wetter, penetrant
- Breaks down waxy leaves with thick cuticles
- i.e. watershield, lotus, lilies, cattails, etc.
- Methylated seed oil – Sun Energy
- Wets & penetrates plant
- Sinking Agents – carry product depths beyond 4' (but so do weighted hoses)
- Check herbicide label for surfactant compatibility & surfactant label for aquatic use

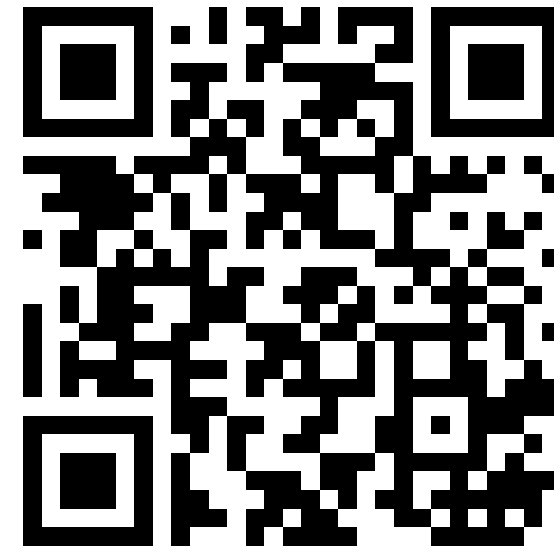


Success Vs. Failure

- Correct Plant ID
- Right herbicide selection
 - Right application method
- Right Rate
- Right Time
- Right Place



Prevention and Public Involvement



**2026 Year of Invasive
Plants - ACES**



Levi Blackmon
South Alabama Aquatic Resources Agent - ACES
Brewton, AL 36426
Cell: 256-624-7356
lcb0094@auburn.edu



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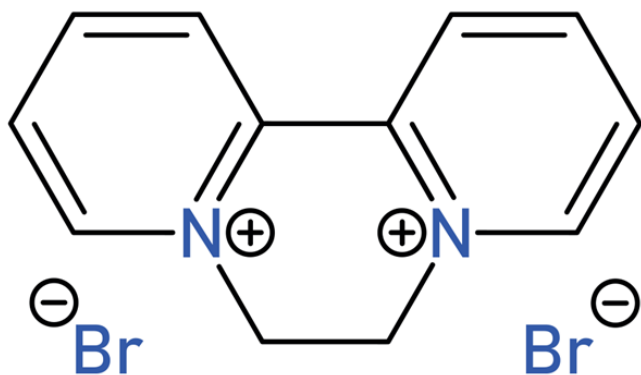
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Copper Sulfate

(Cutrine, Komeen, K-Tea, Captain, Nautique, Argos)

- Primarily an algaecide
- Often used in tank mixes with either diquat dibromide or endothall
- Formulations include copper sulfate pentahydrate and several chelated (complex copper) formulations
- Respect fish copper toxicity – alkalinity dependent on fish toxicity

Diquat dibromide



Diquat Dibromide (Reward, Tribune, Weedtrine-D)

- Contact used for control of submersed weeds and duckweed
- Often used in tank mixes with copper as an algaecide
- Should not be applied to or mixed with muddy water
- Limited effect in shallow water due to binding with organics

2,4-D

(Weedar 64, Aqua-Kleen, Navigate, Hardball, Alligare 2, 4-D Amine)

- Primarily a systemic broadleaf herbicide
- Both liquid and granular formulations
- Very effective on many emergents:
 - Amine - submergents
 - water hyacinths, watermilfoils, water primrose, & parrot feather
- Can control watershield & lilies w/surfactant if not washed off leaves

Glyphosate

(AquaMaster, Shoreline Defense, Rodeo, Roundup Custom, Aqua Star)

- Broad-spectrum herbicide for most emergent weeds
- Water lily and watershield may be controlled if wave action does not wash herbicide off the floating leaves.
- Not for submersed application
- Not effective on small, floating plants such as duckweed, watermeal, or mosquito fern.

Endothall

(Hydrothol 191, Aquathol, Aquathol K)

- Contact herbicide (some translocation) in granule & liquid formulations
- Controls normally difficult “pondweeds” *Potamogeton spp.* And many other submersed weeds
- Very ‘HOT’ herbicide
 - Can kill fish (says so on the label)
 - Will burn & blister skin

Fluridone

(Sonar AS, Avast!, Whitecap)

- Slow acting herbicide for control of most submersed weeds.
- Can 'creep' up emergent & marginal vegetation
- Requires a long (45 day) contact time & minimal water exchange
- Extended irrigation restriction – 30 days
- No fish kills from oxygen depletion as plants slowly die and decay over weeks to months
- \$\$ Expensive \$\$ (\$245 / ac. ft.)

Flumioxazin

(Clipper, Propeller, Flumigard)

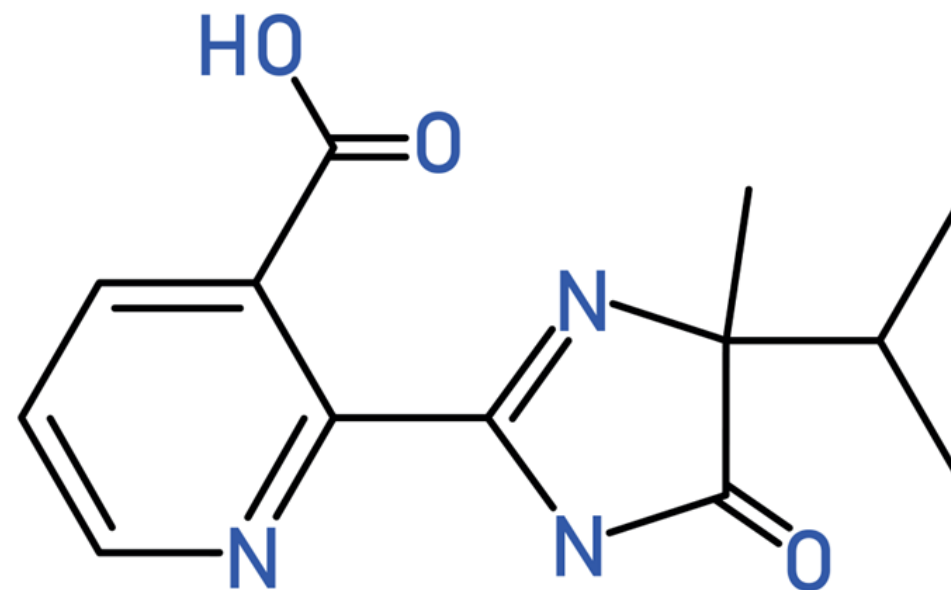
- Flowable granule (dissolves when tank mixed – mix well!)
- FAST acting control of most aquatic weeds
- Best in systems with lower pH
- Great option for watershield, duckweed, & watermeal
 - More economical than fluridone (~\$100/ac.)
- Does not require long contact time or minimal water exchange (4-6 hr. contact required)

Imazapyr

(Habitat, Arsenal, Polaris, Ecomazapyr 2 SL)

- Great option for emergent plants (cattails, alligator weed, giant reed, water shield)
- More expensive (~\$200+/ac.)
- Unaffected by rain within 1 hour of application – rapidly absorbed by plants
- Long turf and crop irrigation restriction – 120 days
- **DO NOT USE AROUND DESIRED TREES**

Imazapyr



Triclopyr

(Renovate, Navitrol, Garlon 3A)

- Systemic herbicide for broadleaf control – emerged, floating, and some submersed plants
- Great option for alligator weed, water hyacinth, water milfoil, American lotus
- Use surfactant for floating and emergent vegetation
- Use sinking agent / adjuvant or weighted hose for submersed species
- Long crop irrigation restriction – 120 days