GROUP	14	HERBICIDE

Clipper™ Herbicide

For management of aquatic weeds in bayous, canals, drainage ditches, fresh water ponds, lakes, marshes and reservoirs

Active Ingredient	By Wt.
Flumioxazin*	51%
Other Ingredients	49%
Total	100%

*2-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propynyl)-2*H*-1,4-benzoxazin-6-yl]-4,5,6,7-tetrahydro-1*H*-isoindole-1,3(2*H*)-dione

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

KEEP OUT OF REACH OF CHILDREN

CAUTION

SEE NEXT PAGE FOR ADDITIONAL PRECAUTIONARY STATEMENTS.

NET WEIGHT___POUNDS

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS & 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.

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 15-20 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 eye. • 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 the 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 **1-800-892-0099** for emergency medical treatment information.

PERSONAL PROTECTIVE EQUIPMENT (PPE):

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

Applicators and other handlers must wear: long-sleeved shirt and long pants, chemical-resistant gloves made of any waterproof material such as polyethylene or polyvinyl chloride, shoes and socks.

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

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.

ENVIRONMENTAL HAZARDS:

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.

This pesticide is toxic to plants and should be used strictly in accordance with the drift and run-off precautions on this label in order to minimize off-site exposures.

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 treatment area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

**DISCLAIMER, RISKS OF USING THIS PRODUCT,
LIMITED WARRANTY
AND LIMITATION OF LIABILITY**

IMPORTANT: Read the entire Label including this Disclaimer, Risks of Using this Product, Limited Warranty, and Limitation of Liability before using this product. If the terms are not acceptable THEN DO NOT USE THE PRODUCT; rather, return the unopened product within 15 days of purchase for a refund of the purchase price.

RISKS OF USING THIS PRODUCT

The Buyer and User (referred to collectively herein as "Buyer") of this product should be aware that there are inherent unintended risks associated with the use of this product which are impossible to eliminate. These risks include, but are not limited to, injury to plants and crops to which this product is applied, lack of control of the target pests or weeds, resistance of the target pest or weeds to this product, injury caused by drift, and injury to rotational crops caused by carryover in the soil. If the Buyer chooses not to accept these risks, THEN THIS PRODUCT SHOULD NOT BE APPLIED. By applying this product Buyer acknowledges and accepts these inherent unintended risks AND TO THE FULLEST EXTENT ALLOWED BY LAW, AGREES THAT ALL SUCH RISKS ASSOCIATED WITH THE APPLICATION AND USE ARE ASSUMED BY THE BUYER.

Valent shall not be responsible for losses or damages resulting from use of this product in any manner not set forth on the label. Buyer assumes all risks associated with the use of this product in any manner or under conditions not specifically directed or approved on the label.

LIMITED WARRANTY

Valent warrants only that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated in the label, under average use conditions, when used strictly in accordance with the label and subject to the Risks of Using This Product as described above. To the extent consistent with applicable law AND AS SET FORTH ABOVE, VALENT MAKES NO OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED. No agent or representative of Valent or Seller is authorized to make or create any other express or implied warranty.

LIMITATION OF LIABILITY

To the fullest extent allowed by law, Valent or Seller is not liable for any incidental, consequential, indirect or special damages resulting from the use or handling of this product. TO THE FULLEST EXTENT ALLOWED BY LAW, THE EXCLUSIVE REMEDY OF THE BUYER, AND THE EXCLUSIVE MAXIMUM LIABILITY OF VALENT OR SELLER FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY, CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT SHALL BE THE RETURN OF THE PURCHASE PRICE OF THIS PRODUCT OR, AT THE ELECTION OF VALENT OR SELLER, THE REPLACEMENT OF THE PRODUCT.

PROMPT NOTICE OF CLAIM

To the extent consistent with applicable law allowing such requirements Valent must be provided notice as soon as Buyer has reason to believe it may have a claim, but in no event later than twenty-one days from the date of application so that an immediate inspection of the affected property can be made.

To the extent consistent with applicable law if Buyer does not notify Valent of any claims, in such period, it shall be barred from obtaining any remedy.

NO AMENDMENTS

Valent and Seller offer this product, and Buyer accepts it, subject to the foregoing **Disclaimer, Risks of Using This Product, Limited Warranty** and **Limitation of Liability,** which may not be modified by any oral or written agreement.

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.

Read and follow the entire label of each product to be used in the tank mix with this product.

PRODUCT INFORMATION

Clipper Herbicide is a broad spectrum contact herbicide for control of invasive and noxious weeds in various water bodies with limited or no outflow. *Clipper* Herbicide controls weeds by inhibiting protoporphyrinogen oxidase, an essential enzyme required by plants for chlorophyll biosynthesis.

Clipper Herbicide is fast acting, and can be applied subsurface to control submersed and floating aquatic weeds. *Clipper* Herbicide can also control floating and emergent weeds growing on or above the water surface when the product is applied to the foliage of those plants. It is most effective when applied to young, actively growing weeds in water with a pH of less than 8.5. *Clipper* Herbicide breaks down rapidly and loses herbicidal effectiveness in high pH water (pH greater than 8.5).

Clipper Herbicide may be applied to the following bodies of water where there is limited or no outflow:

- Bayous
- Canals*
- Drainage ditches
- Lakes
- Marshes
- Fresh Water Ponds
- Reservoirs

*For application only to non-flowing canal water that will not be released for irrigation until 5 days after application.

Application of *Clipper* Herbicide to public aquatic areas may require special approval and/or permits. Consult with local state agencies, if required.

USE PRECAUTIONS AND RESTRICTIONS

- Do not apply to flowing water, intertidal or estuarine areas.
- There is no post-application holding restriction against use of treated water for drinking or recreational purposes (e.g. swimming, fishing).
- Treated water may not be used for irrigation purposes until at least five days after application.
- Do not use in water utilized for crawfish farming.
- Do not re-treat the same section of water with *Clipper* Herbicide more than 6 times per year.

RESISTANCE MANAGEMENT

Clipper Herbicide is a Group 14 herbicide. Any weed population may contain or develop plants that are resistant to *Clipper* Herbicide and other Group 14 herbicides. Weed species with acquired resistance to Group 14 herbicides may eventually dominate the weed population if Group 14 herbicides are used repeatedly in the same water body or in successive years as the primary method of control for targeted species. This may result in partial or total loss of control of those species by *Clipper* Herbicide or other Group 14 herbicides.

To delay or prevent herbicide resistance consider the following recommendations:

- Avoid the consecutive use of *Clipper* Herbicide or other herbicides that have a similar target site of action.
- Alternate herbicides used for aquatic weed control.
- Base herbicide use on a comprehensive Integrated Pest Management (IPM) program.
- Monitor treated weed populations for loss of efficacy.
- Contact your local extension specialist, other experts appropriate to aquatic use, and/or manufacturer for resistance and/or integrated weed management recommendations.

For further information or to report suspected resistance, you may contact Valent U.S.A. Corporation at the following toll-free number: 800-89-VALENT (898-2536).

SPRAY DRIFT MANAGEMENT FOR FOLIAR OR SURFACE APPLICATIONS

Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment and weather-related factors determine the potential for spray drift. The applicator is responsible for considering all these factors when making decisions.

Do not spray *Clipper* Herbicide under circumstances where spray droplets may drift on to unprotected persons, or plantings of food, forage or crops that might be damaged, or rendered unfit for sale, use or consumption. These precautions are not applicable for subsurface injection by closed systems.

- Use the largest droplet size consistent with acceptable efficacy. Formation of very small droplets may be minimized by appropriate nozzle selection, by orienting nozzles away from the air stream as much as possible and by avoiding excessive spray boom pressure. For ground boom and aerial applications, use medium or coarser spray nozzles according to ASAE 572 definition for standard nozzles or a volume mean diameter (VMD) of 300 microns or greater for spinning atomizer nozzles.
- Make aerial, ground or watercraft-based applications when wind velocity favors on-target product deposition. Apply only when the wind speed is less than or equal to 10 mph.

- Do not make aerial or ground applications into areas of temperature inversions. Inversions are characterized by stable air and increasing temperatures with increasing distance above the ground. Mist or fog may indicate the presence of an inversion in humid areas. Where permissible by local regulations, the applicator may detect the presence of an inversion by producing smoke and observing a smoke layer near the ground surface.
- Low humidity and high temperatures increase the evaporation rate of spray droplets, and therefore the likelihood of increased spray drift. Avoid spraying during conditions of low humidity and/or high temperatures.

Properly maintain and calibrate all aerial, ground and water based application equipment.

Where states have more stringent regulations, they should be observed.

APPLICATION AND SPRAYER INFORMATION

Mixing Instructions

- Mix with water having pH of 5 to 7. If pH is higher than 7, use an appropriate buffer to reduce pH to desirable range.
- Fill clean spray tank 1/2 full of desired level with water and add buffering agent if necessary.
- Add the required amount of *Clipper* Herbicide to the spray tank while agitating.
- Fill spray tank to desired level with water. Ensure that *Clipper* Herbicide is thoroughly mixed before making applications. Agitation should continue until spray solution has been applied.
- Mix only the amount of spray solution that can be applied the day of mixing. Apply *Clipper* Herbicide within 12 hours of mixing.

ADDITIVES

When applying *Clipper* Herbicide to the foliage of floating or emerged aquatic weeds, mix with an adjuvant approved for use in aquatic sites. Valent recommends the use of a Chemical Producers and Distributors Association certified adjuvant. Mix *Clipper* Herbicide with a non-ionic surfactant containing at least 80% active ingredient. Follow adjuvant manufacturer's label rates. Mixing compatibility should be verified by a jar test before using.

Jar Test to Determine Compatibility of Adjuvants and *Clipper* Herbicide

Conduct a jar test before mixing commercial quantities of *Clipper* Herbicide, when using for the first time, when using new adjuvants or when a new water source is being used.

1. Add 1 pt of water to a quart jar. The water should be from the same source and have the same temperature as the water used in the spray tank mixing operation.
2. Add 3 grams (approximately 1 level tsp) of *Clipper* Herbicide for the 8 oz/A rate or 4 grams (approximately 1-1/2 tsp) for 12 oz/A rate to the jar. Gently mix until product disperses.
3. Add 60 ml (4 Tbsp or 2 fl oz) of additive to the quart jar and gently mix.

4. If nitrogen is being used, add 16 ml (1 Tbsp) of the 28 to 32% nitrogen source to the quart jar. If ammonium sulfate is being used, add 19 grams of AMS to the quart jar in place of the 28 to 32% nitrogen.
5. Place cap on jar, invert 10 times, let stand for 15 minutes, evaluate.
6. An ideal tank mix combination will be uniform and free of suspended particles. If any of the following conditions are observed the choice of adjuvant should be questioned:
   a) Layer of oil or globules on the solution surface.
   b) Flocculation: Fine particles in suspension or as a layer on the bottom of the jar.
   c) Clabbering: Thickening texture (coagulated) like gelatin.

Sprayer Cleanup

If spray equipment is dedicated to application of aquatic herbicides, the following steps are recommended to clean the spray equipment:

- Completely drain the spray tank and rinse the application equipment thoroughly, including the inside and outside of the tank and all in-line screens.

If spray equipment will be used for purposes other than applying aquatic herbicides, it must be thoroughly cleaned following application of *Clipper* Herbicide. The following steps must be used to clean the spray equipment:

1. Completely drain the spray tank and rinse the application equipment thoroughly, including the inside and outside of the tank and all in-line screens.
2. Fill the tank with clean water and flush all hoses, booms, screens and nozzles.
3. Top off tank with clean water.
4. Circulate through sprayer for 5 minutes.
5. Then flush all hoses, booms, screens and nozzles for a minimum of 15 minutes.
6. Drain tank completely.
7. Remove all nozzles and screens and rinse them with clean water.

DIRECTIONS FOR USE TO CONTROL FLOATING AND EMERGED WEEDS USING SURFACE APPLICATION

Clipper Herbicide will control weeds and algae listed in Table 1 when applied as a broadcast spray with appropriate equipment. For best results, apply *Clipper* Herbicide to the foliage of actively growing weeds.

Table 1. Floating and Emerged Weeds

Common Name	Scientific Name
Alligator Weed	*Alternanthera philoxeroides*
Frog's-bit	*Limnobium spongia*
Water Fern	*Salvinia* spp.
Water Lettuce	*Pistia stratiotes*
Water Pennywort	*Hydrocotyle* spp.
Filamentous algae	*Pithophora*
Filamentous algae	*Cladophora*

Surface Application

Apply *Clipper* Herbicide as a broadcast spray at 6 to 12 ounces of formulated product per acre. Apply in a sufficient volume of water per acre to ensure adequate coverage. Buffer spray solution to pH less than 7.0 (see Mixing Instructions).

Application of *Clipper* Herbicide during early morning hours may enhance weed control. When applying to densely packed actively growing surface weeds, ensure adequate coverage. A second application may be required for complete control under these conditions. Rapid decomposition of vegetation resulting from herbicide treatment can result in loss of oxygen in water. A sudden decrease in dissolved oxygen can result in fish suffocation. If aquatic vegetation is dense, treat floating surface weeds in sections to avoid a rapid decrease in dissolved oxygen. Treat up to half of the water body and wait 10 to 14 days before treating the remaining area. Do not re-treat the same section of water within 28 days of application.

Clipper Herbicide may be tank mixed with 2,4-D, diquat or other registered foliar applied herbicides for enhanced control of floating and emergent weeds.

Consult a manufacturer's label for specific rate restrictions and weeds controlled. Always follow the most restrictive label restrictions and precautions for all products used when making an applications involving tank mixes.

Floating Filamentous Algae

When applied at rates of 6 to 12 ounces per acre as a surface spray, *Clipper* Herbicide provides control of floating filamentous algae, including Pithophora and Cladophora. Follow application instructions for surface foliar applications.

Application Equipment
Apply *Clipper* Herbicide with sprayers equipped with nozzles designed to deliver the desired spray pressure and spray volume. Apply by backpack or handgun sprayer, airboat, helicopter, airplane or other application equipment that will ensure thorough coverage of target plant foliage.

AERIAL APPLICATION
Apply *Clipper* Herbicide by air at 6 to12 ounces of formulated product per acre. To obtain satisfactory weed control, aerial application of *Clipper* Herbicide, must provide uniform coverage of weeds. Do not apply by air when drift is possible or when wind velocity is more than 10 mph. Avoid spraying *Clipper* Herbicide within 200 feet of dwellings, adjacent sensitive crops or environmentally sensitive areas. To obtain satisfactory application and avoid drift, the following directions must be observed:

Volume and Pressure
Apply *Clipper* Herbicide in 5 to 10 gals of water per acre, with a maximum spray pressure of 40 PSI. Application at less than 5 gals per acre may not provide adequate weed control. Higher gallonage applications generally provide more consistent weed control.

Nozzles and Nozzle Operation
Use nozzles that produce flat or hollow cone spray patterns. Use non-drip type nozzles such as diaphragm type nozzles to avoid unwanted discharge of spray solution. The nozzle must be directed toward the rear of the aircraft, at an angle between 0° and 15° downward. Do not place nozzles on the outer 25% of the wings or rotors.

Adjuvants
Refer to the additive section or the tank mix partners label for adjuvant recommendation.

DIRECTIONS FOR USE TO CONTROL SUBMERSED AND FLOATING WEEDS USING SUBSURFACE APPLICATION

Clipper Herbicide will control submersed and floating weeds listed in Table 2, when applied subsurface with appropriate equipment.

Apply uniformly to ensure sufficient contact time. *Clipper* Herbicide breaks down rapidly, and uniform coverage is essential to maximize efficacy

Table 2. Submersed and Floating Weeds Controlled by Subsurface Application

Common Name	Scientific Name
Coontail	*Ceratophyllum demersum*
Duckweed	*Lemna* spp.
Fanwort	*Cabomba caroliniana*
Hydrilla	*Hydrilla verticillata*
Naiad, Southern	*Najas guadalupensis*
Pondweed, Curlyleaf	*Potamogeton crispus*
Pondweed, Illinois	*Potamogeton illinoensis*
Pondweed, Sago	*Potamogeton pectinatus*
Pondweed, Variable-Leaf	*Potamogeton diversifolius*
Water Fern	*Salvinia* spp.
Water Lettuce	*Pistia stratiotes*
Watermeal	*Wolffia* spp.
Watermilfoil, Eurasian	*Myriophyllum spicatum*
Watermilfoil, Variable-Leaf	*Myriophyllum heterophyllum*

Best results will be achieved when applied to young or actively growing vegetation. *Clipper* Herbicide will be most efficacious against submersed weed species when applied to actively growing plants with limited biomass, and when weeds are growing in lower pH (less than 8.5) waters with high light penetration into the water column. Rapid decomposition of vegetation resulting from herbicide treatment can result in loss of oxygen in water. A sudden decrease in dissolved oxygen can result in fish suffocation. If aquatic vegetation is dense, treat water body in sections to avoid a rapid decrease in dissolved oxygen. Treat up to half of the water body and wait 10 to 14 days before treating the remaining area. Do not retreat the same section of water within 28 days of application.

Subsurface Application Rates

Apply *Clipper* Herbicide at a rate that will produce an initial concentration of 100 to 400 ppb (of active ingredient flumioxazin) in the water column. Apply in a sufficient volume of water per acre to ensure adequate contact with target weeds. Use Table 3 to determine amount of *Clipper* Herbicide needed to achieve desired concentration at different water depths. Use higher concentrations when weed biomass is heavy and/or weeds are more mature and topped out. Do not exceed 400 ppb of active ingredient flumioxazin during any one application. When making applications to water bodies greater than 7 feet deep, do

not exceed 14.8 pounds of product per surface acre. Buffer spray solution to pH less than 7.0 (see Mixing Instructions).

Due to photosynthetic processes of submersed plants and algae, water pH tends to be lower in early morning hours compared to afternoon hours. Therefore, in water bodies with a higher pH, apply as early in the morning as possible to maximize the length of time *Clipper* Herbicide will remain at efficacious concentrations in the water column.

Application Equipment

To ensure adequate coverage, apply *Clipper* Herbicide with weighted trailing hoses in order to place the herbicide under the surface and throughout the biomass of aquatic vegetation. Keep swath width to a minimum in order to maximize contact with submersed aquatic vegetation.

Information on Hydrilla Control

For best control of hydrilla, apply during the late Winter (February/March) and Fall (October/November). Efficacy of *Clipper* Herbicide will be enhanced at these timings due to lower potential biomass present and lower pH of the water. If applied to mature topped out hydrilla, *Clipper* Herbicide will cause some discoloration and loss of growing tips, but regrowth will be rapid.

Clipper Herbicide may be tank mixed with other aquatic herbicides and applied as a subsurface treatment for hydrilla control. Hydrilla control may be improved by tank mixing *Clipper* Herbicide with Reward® Landscape and Aquatic Herbicide or other registered contact herbicides.

Consult a manufacturer's labels for specific rate restrictions and weeds controlled. Always follow the most restrictive label restrictions and precautions for all products used when making an applications involving tank mixes.

Effects of Water pH on Control of Submersed Plants

All aquatic herbicides require specific concentration and contact times in order to control aquatic weeds. *Clipper* Herbicide is very rapidly absorbed by target plants, but also breaks down rapidly in water with a pH greater than 8.5. The pH of water surrounding mats of submersed vegetation can exceed 8.5 by early to mid-day, due to photosynthetic processes. Application of *Clipper* Herbicide under these conditions may only provide partial weed control, and rapid regrowth is likely. For best control, apply *Clipper* Herbicide in the early morning to actively growing aquatic weeds and early in the season before surface matting occurs. Application of *Clipper* Herbicide with weighted hoses designed to distribute the herbicide within the plant stand will generally provide more effective and longer term control of submersed weeds.

Table 3. Subsurface Application Rates

Water Depth (feet)	Pounds of *Clipper* Herbicide required per surface acre to achieve desired water concentration		
	100 ppb	200 ppb	400 ppb
1	0.53	1.1	2.1
2	1.1	2.1	4.2
3	1.6	3.2	6.4
4	2.1	4.2	8.5
5	2.6	5.3	10.6
6	3.2	6.4	12.7
7	3.7	7.4	14.8

Example: to achieve an initial concentration of 100 ppb of flumioxazin in a 4 foot deep water column, apply 2.1 lbs of *Clipper* Herbicide per surface acre.

STORAGE AND DISPOSAL

PESTICIDE STORAGE

Do not contaminate water, food or feed by storage, disposal or cleaning of equipment.
Keep pesticide in original container.
Store in a cool, dry, secure place.
Do not put formulation or dilute spray solution into food or drink containers.
Do not contaminate food or foodstuffs.
Do not store or transport near feed or food.
Not for use or storage in or around the home.
For help with any spill, leak, fire or exposure involving this material, call day or night **(800) 892-0099**.

PESTICIDE DISPOSAL

Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER HANDLING

Nonrefillable container. Do not reuse or refill this container. Offer for recycling if available. Clean container promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times.

Clipper is a trademark of Valent U.S.A. Corporation
Reward is a registered trademark of Syngenta Group Company

Manufactured for:
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Walnut Creek, CA 94596-8025
www.valent.com

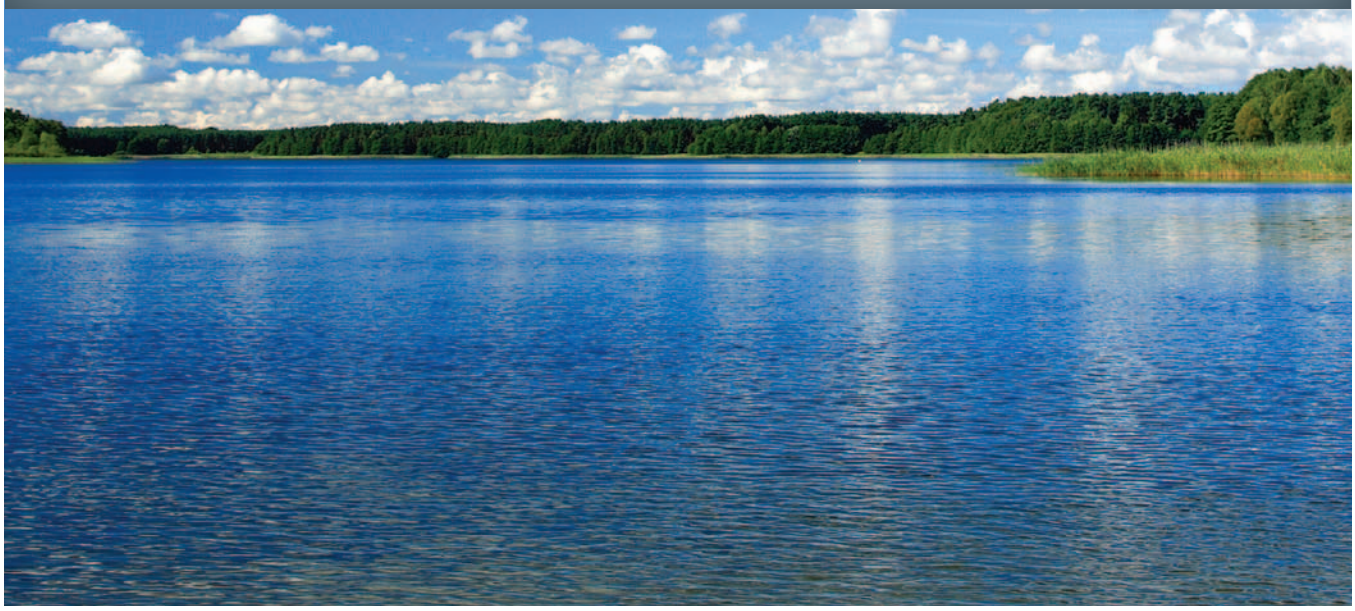
Made in U.S.A.

EPA Reg. No. 59639-RAR
EPA Est.

{AQUATIC HERBICIDE WHITE PAPER}

New Chemistry for Aquatic Weed Management

Technical Findings on Clipper™ (flumioxazin) and Tradewind™ (bispyribac-sodium) Herbicides



Introduction

Invasive and nuisance aquatic plant species are a significant and increasing problem in water bodies throughout the United States. Invasive weeds such as hydrilla, cabomba (fanwort), Eurasian watermilfoil, water lettuce, water hyacinth and watermeal are damaging fish and wildlife habitats, blocking previously navigable areas, restricting recreation and decreasing property values. Nationwide, costs associated with the chemical and mechanical management of these weeds exceed $150 million per year in public funds, according to a June 2008 article in *Outlooks on Pest Management*.[1]

In 2010, Valent Professional Products plans to launch a new portfolio of aquatic products offering new solutions to help control aquatic weeds. These new products—Clipper™ Herbicide (flumioxazin) and Tradewind™ Herbicide (bispyribac-sodium)—are intended to provide aquatic plant managers with new treatment options at a time when herbicide resistance, variable response and environmental concern issues loom large.

Clipper and *Tradewind* are currently being evaluated under Federal Experimental Use Permits (EUPs) in various states throughout the country, and this document cites some of the key findings from these studies.

CURRENT AQUATIC HERBICIDE SITUATION

As recently as 15 years ago, the number of aquatic herbicides available for use in U.S. waters was extremely limited. To control hydrilla, aquatic plant managers used diquat, endothall and fluridone. For filamentous algae, copper was the product of choice. "In 1995 we had six products registered for aquatic use and we were pretty happy," said Dr. Bill Haller, acting director of the University of Florida's Center for Aquatic and Invasive Plants. In those days, Dr. Haller said, fluridone could be expected to control hydrilla, a submersed weed, for one or even two years. Magnacide (acrolein) was used liberally to clear agricultural irrigation canals of unwanted weeds, but Dr. Haller said there were environmental concerns associated with this product.

> **"For the longest time we only had six or seven active ingredients for aquatics."**
>
> — Joe Bondra, vice president and general manager of Cygnet Enterprises, Inc.

"For the longest time we only had six or seven active ingredients for aquatics," said Joe Bondra, vice president and general manager of Cygnet Enterprises, Inc., the largest single-source distributor of aquatic management products in the country. "Until recently, there hadn't been many new tools in the toolbox for the lake manager to pick from."

As environmental concerns increased and resistance issues emerged, a market for new herbicides with different modes of action developed and continues to grow. The state of Florida alone, Dr. Haller said, is now spending $25 million per year on aquatic weed control.

"I've been in aquatic plant management over 20 years and have really seen the market expand in the last 10 years," said Chip Davis of Santee Cooper's Analytical & Biological Services Division in South Carolina. "There's always room for more products in terms of selectivity. We're at the point now where we've got selective control. We can take out the undesirable weeds but still keep the desirable plant species, which is especially important in some of our habitat enhancement projects."

However, aquatic resource managers do not have control over all invasive plant species. "Despite public programs for containment and prevention of the spread of aquatic weeds, the exotic submersed species hydrilla has spread from Florida to Maine on the East Coast, across the Gulf Coast states, and to California and Washington on the West Coast," according to the aforementioned 2008 *Outlooks on Pest Management article*.

An article in the 2008 edition of the *Journal of Aquatic Plant Management* advises readers that "the invasive exotic plants hydrilla and Eurasian watermilfoil continue to spread and remain the plant species of greatest concern for aquatic resource managers at the national scale.[2]"

The difficulty in controlling these weeds, and the increasing resistance of some species, underscores the need for a continual flow of products with new modes of action into the marketplace. "Having different modes of action is important for lake managers," Bondra said. "Agriculture has rotated treatments for decades, due in part to the limited number of choices available. We have not rotated in aquatics. Now that there will be more products with different modes of action and active ingredients, the aquatic manager will have the flexibility to rotate products as deemed appropriate."

CLIPPER HERBICIDE (FLUMIOXAZIN)
Expected availability: Q1 2010

A fast-acting, contact herbicide, the active ingredient in *Clipper*, flumioxazin, controls aquatic weeds such as cabomba, watermeal, water lettuce, duckweed, and, as part of a tank mix, hydrilla. *Clipper*, which works best during the early-growth stage of most weeds, also shows promise for control of some species of algae. Because studies show *Clipper* dissipates quickly from the water column and does not accumulate in the sediment, Valent Professional Products research and development manager Mike Riffle said it is less of an environmental concern than other, more persistent herbicides. *Clipper* can also be applied to control floating or submersed weeds, providing flexibility to applicators.

Besides providing aquatic resource managers with a new mode of action, *Clipper* also has low use rates of 6 to 12 ounces of product per surface acre on floating and emergent weeds and 100 to 400 parts per billion (ppb) on submersed weeds, according to Riffle.

Key Treatment Target:

Cabomba/Fanwort: A fast-growing, submersed weed, cabomba thrives in slow-moving waters and, because of the limited number of herbicides available, is difficult to eradicate once it becomes established. Bondra of Cygnet worked on EUP trials with *Clipper* and said he was "extremely excited about flumioxazin." His enthusiasm is most evident in relation to *Clipper*'s activity on cabomba.

"We know from the EUP work that *Clipper* has great efficacy on cabomba," Bondra said. "Some applicators have told me you can run over cabomba with a truck and still not kill it."

"There is a real need for a predictable cabomba treatment," he added. "*Clipper* on cabomba was, in a word, awesome. The EUP trials seem to indicate that flumioxazin doesn't need as much contact time (as other products)."

Indiana EUP trial

Conducted by Cygnet Enterprises, Inc.
Target weed: Cabomba
Rate: 200 ppb

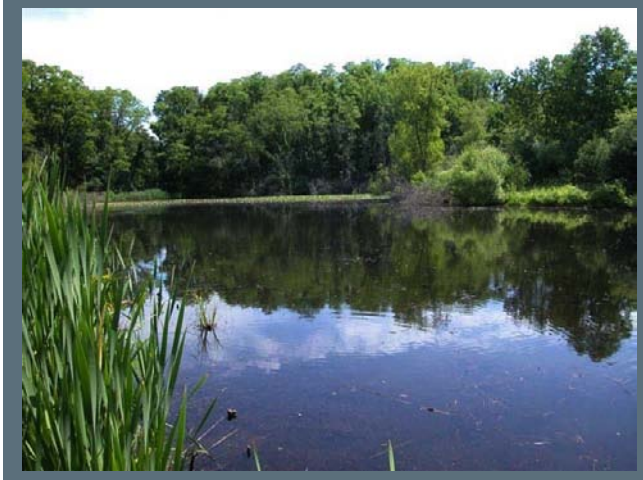
Pretreatment

7 days after treatment with *Clipper*

Indiana EUP trial

Conducted by Cygnet Enterprises, Inc.
Target weed: Cabomba
Rate: 200 ppb, Water pH: 7.8 to 8.0

Pretreatment



14 days after treatment with *Clipper*

Davis, meanwhile, said that "we have had a big problem with cabomba in our lake system over the years with limited success in controlling it. Flumioxazin consistently gave us excellent control in the EUP trials."

In treating an 11-acre canal at Old Santee Canal Park that was "pretty much 100% cabomba and basically impassable for canoeists, prior to the trial" Davis said "it was amazing the results realized [with *Clipper*]." Applied in late July 2008 at a rate of 200 ppb, *Clipper* provided 100% control of cabomba—as well as duckweed and watermeal—within three weeks of a subsurface application. By fall, Davis said, "it was absolutely perfect for the remainder of the year."

In mid-September 2008, Davis treated a 20-acre section of a 150-acre impoundment on Lake Marion with *Clipper* and said it "completely removed the cabomba from the treatment site." The early assessment this year is that there is still no cabomba present. "It selectively controlled the cabomba very quickly with control extending, so far, into this year," Davis said.

Key Treatment Target:

Watermeal: A small, free-floating rootless plant, watermeal thrives in quiescent waters. An aggressive pond invader, it forms dense colonies and depletes oxygen, often resulting in a fish kill.

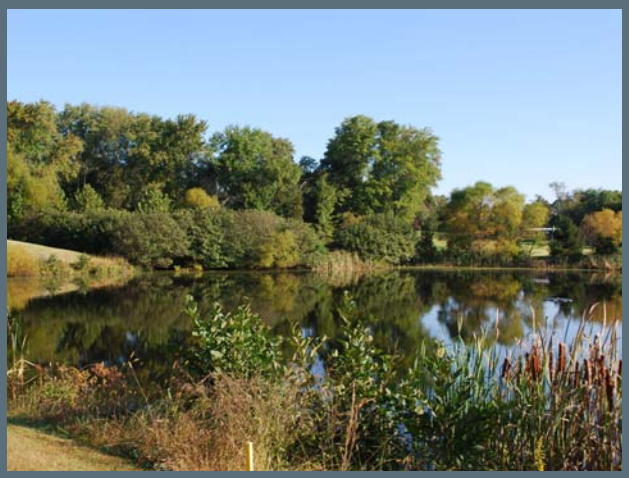
Kevin Tucker, owner and president of Virginia Lake Management Co., has been a cooperator in multiple EUP trials in each of the last two years. In 2008, at a concentration of 200 ppb, Tucker applied *Clipper* to a pair of small ponds that were nearly 100% contaminated with watermeal.

In one pond, Tucker said, "all the watermeal was gone within a few days to a week, and we never saw it again." In the other pond, he added, the majority of the watermeal was gone within a week. After some apparent regrowth, a second treatment wiped the watermeal out for good.

In all, Tucker treated eight ponds with *Clipper* and saw good control in all eight upon the initial application. Only once was Tucker forced to make a second application, and he said that was because of new plant material flowing in rather than previously treated plants coming back.

Virginia EUP trial
Conducted by Virginia Lake Management Co.
Target weed: Watermeal, Rate: 200 ppb

Pretreatment



18 days after treatment with *Clipper*

"It looks like a miracle product for watermeal from what I've seen," Tucker said.

Tucker added that *Clipper* "seemed to take out the watermeal and leave the desirable native plants behind."

Surface applications of *Clipper* resulted in "great activity" on watermeal, according to Bondra. Watermeal can be problematic in lakes, ponds and reservoirs across the United States.

"I assisted with some of the plots myself and saw with my own eyes," Bondra said. "Watermeal is a huge problem and it's hard to kill, but we saw great activity with flumioxazin. Typically, watermeal treatment results with other products can be very inconsistent. In my opinion, we have never really had a good go-to option to control watermeal each and every time." Bondra also saw activity on sago pondweed, a plague of irrigation canals in several Western states.

"It looks like a miracle product for watermeal..."

— Kevin Tucker, owner and president of Virginia Lake Management Co.

EUP Trial Results—Watermeal

Trial location	Applicator	App. method	App. rate	Target weed	Results
Virginia Beach, Va.	Kevin Tucker	Sub-surface	400 ppb	Watermeal	100% covered at application. Less than 1% coverage within three weeks of application.
Virginia Beach, Va.	Kevin Tucker	Sub-surface	200 ppb	Watermeal	100% covered at application. Less than 1% coverage within three weeks of application.

Filamentous algae: Citing the "huge need for a non-copper algaecide," Bondra said he saw results with *Clipper* on algae despite not really targeting it. "In most of the EUP work, algae was not the target, but I did see activity on it," he said. The University of Florida's Dr. Haller said, "It looks like flumioxazin has some activity on algae. We've written up a research grant proposal to the EPA to investigate this finding with flumioxazin on algae further."

Riffle said, "There is some evidence that *Clipper* is controlling filamentous algae. That's important because right now there is no alternative except copper, which is under a bit of fire right now due to environmental fate issues."

Other invasive weeds: While Bondra said *Clipper* is probably best used as a tank mix with diquat to combat hydrilla, he said there's no need to mix *Clipper* in order to deal with Eurasian watermilfoil. Difficult to remove once it becomes established, Eurasian watermilfoil can be treated, upon registration, with contact herbicides like *Clipper*.

"It has great activity on Eurasian watermilfoil," Bondra said of *Clipper*. "That's one of the most exciting things about it—it works very quickly and doesn't stay around long." That's particularly true, Bondra added, since milfoil seems to be starting to show some variable response issues to granular 2,4-D treatments, forcing aquatic managers to apply 2,4-D at the higher labeled rates.

Target Weed: Eurasian Watermilfoil
Rate: 200 ppb

Untreated

Clipper at 200 ppb

Tests performed by third-party research groups in association with the Aquatic Ecosystem Restoration Foundation (AERF), such as the U.S. Army Engineer Research and Development Center (ERDC) in Vicksburg, Miss., found that *Clipper* can provide an alternate mode of action for controlling giant salvinia. Studies have also indicated that *Clipper* is efficacious against giant salvinia via broadcast and subsurface application techniques, providing acceptable plant control.

The addition of another effective product, along with glyphosate and diquat, promises to diversify the choice of chemical strategies for giant salvinia management and play an important role in resistance management.

Clipper is also effective against hydrilla when used as a tank mix with other herbicides. A mixture of *Clipper* and diquat, in particular, has shown promise against hydrilla, one of the more problematic invasive weeds for aquatic managers to deal with today. When mixed at use rates of 100 ppb (*Clipper*) and 375 ppb (diquat) at five hours of exposure, *Clipper* and diquat provided 81% control of hydrilla, according to a third-party mesocosm study conducted in association with the University of Florida's Center for Aquatic and Invasive Plants. With 20 hours of exposure, control increased to 90%.

"*Clipper* and diquat together do a good job as a contact herbicide on hydrilla," Riffle said. "Because of the resistance issues with fluridone, it is important to have alternatives, and this appears to be one."

TRADEWIND HERBICIDE (BISPYRIBAC-SODIUM)
Expected availability: Q2 2010

A systemic herbicide with long-lasting residual control, the active ingredient in *Tradewind*, bispyribac-sodium, is an acetolactate synthase (ALS)–inhibiting herbicide that controls floating and submersed aquatic weeds. Mostly stable in the water column, *Tradewind* studies point toward an excellent toxicology profile with minimal impact on native species.

Key Treatment Target:

Hydrilla: A submersed aquatic weed introduced into the U.S. around 1960, hydrilla has since spread throughout much of the country. An aggressive, invasive plant, hydrilla adversely affects freshwater lakes, canals, reservoirs and rivers.

Based on EUP field, mesocosm and chamber observations, *Tradewind* provides excellent control of hydrilla.

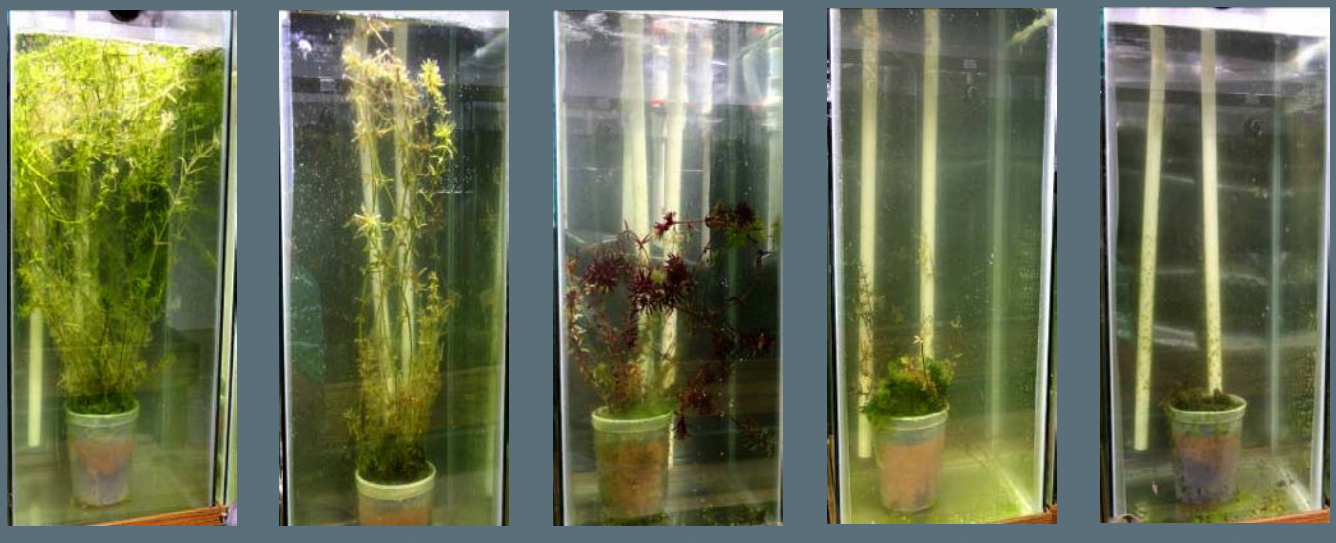
According to a joint study by the University of Florida's Center for Aquatic and Invasive Plants and the U.S. Army Engineer Research and Development Center, *Tradewind* applied at a concentration of 20 ppb and with eight or more weeks of exposure resulted in greater than 90% biomass reduction and growth inhibition in both hydrilla and Eurasian watermilfoil in growth chamber studies.[3]

A separate report by researchers at the Center for Aquatic and Invasive Plants on the efficacy of *Tradewind* on hydrilla in ponds, meanwhile, determined that "a single application of 45 ppb bispyribac-sodium will provide one year of hydrilla control depending upon the time of year in which the herbicide is applied."[4]

"You can get six to 12 months of control of hydrilla consistently with bispyribac," Dr. Haller said. "I think bispyribac is as good as or better than other ALS-inhibitors. We want to kill hydrilla; we don't want to kill any native species. Bispyribac has advantages in terms of selectivity."

Dr. Haller said *Tradewind* was "safe" with regard to non-target aquatic plants such as maidencane, Kissimmee grass and sagittaria plants based on EC50 (µg/L) values. Additionally, Dr. Haller said, *Tradewind* has "greater selectivity than [fellow ALS-inhibitor] penoxsulam on sagittaria." When tested at 27 ppb at Florida's Sand Mine Lake, Dr. Haller said, *Tradewind* did not adversely affect cattail or coontail.

Target Weed: Hydrilla, 16 Weeks After Treatment



Untreated | 5 ppb *Tradewind* | 10 ppb *Tradewind* | 20 ppb *Tradewind* | 40 ppb *Tradewind*

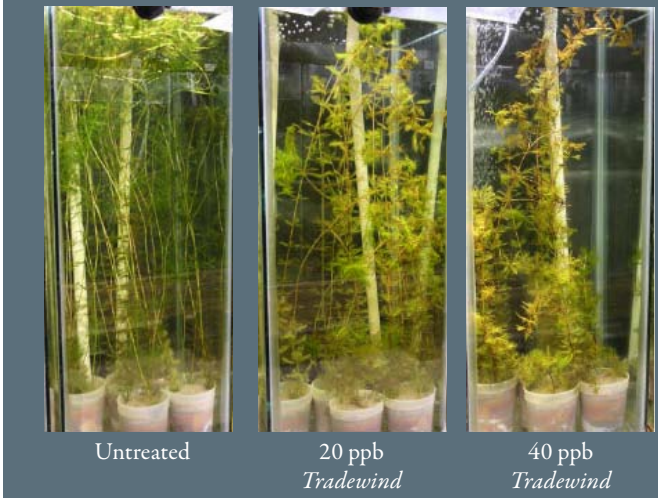
University of Florida EUP Trial
Sand Mine Lake, Eustis, FL
Target Weed: Hydrilla, Rate: 27 ppb

In other studies, Dr. Haller said *Tradewind* had no adverse impact on southern naiad when applied at 50 ppb or on *Vallisneria americana* (wild celery) at 100 ppb.

Other invasive weeds: *Tradewind* shows promise against a number of aquatic weeds in addition to hydrilla. According to EUP field, mesocosm and chamber observations performed by third-party research groups, *Tradewind* provides good-to-excellent (70% or better) control of such troublesome weeds as Eurasian watermilfoil, sago pondweed, water hyacinth and water lettuce when applied as a submersed treatment. As a foliar application, *Tradewind* provided excellent (85% or better) control of water hyacinth and water lettuce.

Also according to tests conducted by third-party researchers, *Tradewind*-treated plants displayed visual herbicide symptoms within two weeks of treatment.

Target Weed: Eurasian Watermilfoil
2 Weeks After Treatment



CONCLUSION

Providing aquatic resource managers with new tools in the fight against invasive weeds, *Clipper* and *Tradewind* are complementary products that can be used as combination partners or in rotation with other products. By bringing new treatment options to an industry in need of them, *Clipper* and *Tradewind* will also help the increasingly important battle against resistance and, hopefully, help reclaim more of the nation's waters and wetlands from noxious, invasive weeds.

Disclaimer

Some of the data presented in this technical guide are from results of studies conducted by the U.S. Army Engineer Research and Development Center (ERDC), under a Cooperative Agreement with the Aquatic Ecosystem Restoration Foundation. Citation of trade names does not constitute an official endorsement or approval of the use of such products by the ERDC.

Footnotes

1) Parochetti, James; Arsenovic, Marija; Getsinger, Kurt D.; Stubbs, Donald; and Haller, William T. "Addressing the Need for Herbicides for Aquatic Weeds in Irrigation Waters in the U.S.," *Outlooks on Pest Management*, June 2008, 19(3):112-16

2) Getsinger, Kurt D.; Netherland, M.D.; Grue, C.E.; and Koschnick, T.J. "Improvements in the Use of Aquatic Herbicides and Establishment of Future Research Directions," *Journal of Aquatic Plant Management*, January 2008, 46:32-41.

3) Slade, Jeremy G.; Poovey, A.G., and Getsinger, K.D. "Bispyribac-sodium 80 SP: Emerging Herbicide for Aquatic Plant Management." 2008 Florida Aquatic Plant Management Society Annual Meeting. Abstract.

4) Berger, Sarah; Haller, William T.; and Puri, Atul. "Valent Herbicides Evaluation for Activity on Hydrilla: Pond Efficacy Results," July 2008.