



DuPont™ Velpar® DF

herbicide



“..... A Growing Partnership With Nature”

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Dispersible Granules

Active Ingredient	By Weight
Hexazinone [3-cyclohexyl-6-(dimethylamino) -1-methyl-1,3,5-triazine-2,4(1H,3H)-dione]	75%
Inert Ingredients	25%
TOTAL	100%

EPA Reg. No. 352-581

KEEP OUT OF REACH OF CHILDREN

DANGER PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

FIRST AID

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 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 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.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-441-3637 for medical emergencies involving this product.

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER! CAUSES EYE DAMAGE.

Corrosive, causes irreversible eye damage. Harmful if swallowed. Do not get in eyes or on clothing. Avoid contact with skin. Wash thoroughly with soap and water after handling.

PERSONAL PROTECTIVE EQUIPMENT

Applicators and other handlers must wear:

Long-sleeved shirt and long pants.

Shoes plus socks.

Protective eyewear.

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. 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.

USER SAFETY RECOMMENDATIONS

USERS SHOULD: Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.

ENVIRONMENTAL HAZARDS

Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwaters.

The active ingredient, hexazinone, in this product is known to leach through soil into ground water under certain conditions as a result of agricultural use. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in ground-water contamination.

GENERAL INFORMATION

DuPont™ VELPAR® DF herbicide is a water-dispersible granule that is mixed in water and applied as a spray for weed control in certain crops, Christmas trees, forestry site preparation and release areas, and industrial areas. It may also be applied as a basal soil treatment for brush control in reforestation areas, rangeland, pastures and noncrop areas.

VELPAR® DF is an effective general herbicide providing both contact and residual control of many annual and biennial weeds and woody plants. It is also effective for control of most perennial weeds.

VELPAR® DF is noncorrosive to equipment.

Caution should be exercised when applying VELPAR® DF near desirable trees or shrubs as they can absorb VELPAR® DF through roots extending in to treated areas.

This product may be applied on conifer plantations and non-crop sites that contain areas of temporary surface water caused by collection of water between planting beds, in equipment ruts, or in other depressions created by management activities. It is permissible to treat intermittent drainage, intermittently flooded low lying sites, seasonally dry flood plains and transitional areas between upland and lowland sites when no water is present. It is also permissible to treat marshes, swamps and bogs after water has receded, as well as seasonally dry flood deltas. DO NOT make applications to natural or man-made bodies of water such as lakes, reservoirs, ponds, streams and canals.

ENVIRONMENTAL CONDITIONS AND BIOLOGICAL ACTIVITY

VELPAR® DF is absorbed through the roots and foliage. Moisture is required to activate VELPAR® DF in the soil. Best results are obtained when the soil is moist at the time of application and 1/4–1/2 inches of rainfall occurs within 2 weeks after application.

For best results, apply VELPAR® DF preemergence or postemergence when weeds are less than 2 inches in height or diameter. Herbicidal activity is most effective under conditions of high temperature (above 80 °F), high humidity, and good soil moisture. Herbicidal activity may be reduced when vegetation is dormant, semi-dormant, or under stress (e.g. temperature or moisture).

Herbicidal activity will usually appear within 2 weeks after application to susceptible plants under warm, humid conditions; while 4–6 weeks may be required when weather is cool or dry, or when susceptible plants are under stress. If rainfall after application is inadequate to activate VELPAR® DF in the soil, plants may recover from contact effects and continue to grow.

On woody plants, symptoms usually appear within 3–6 weeks after sufficient rainfall has carried the herbicide into the root zone during periods of active growth. Defoliation and subsequent refoliation may occur, but susceptible plants are killed.

The degree and duration of control will depend on the following:

- Use rate

- Weed spectrum and size at time of application
- Environmental conditions at and following treatment

Where a rate range is shown, use the higher levels of the dosage range on hard-to-control species, fine-textured soils, or soils containing greater than 5% organic matter or carbon. Use the lower levels of the dosage range on coarse-textured soils and/or on soils low in organic matter. Refer to specific uses for rate ranges.

APPLICATION INFORMATION

VELPAR® DF may be applied by ground equipment and, where permitted, aerial equipment. Use rates, minimum spray gallonage, and other application information are described for various uses.

Dispose of the equipment washwater by applying it to a use-site listed on this label or in accordance with directions given in the “Storage and Disposal” section of this label.

Before spraying, calibrate equipment to determine the quantity of water necessary to uniformly and thoroughly cover the vegetation and soil in a measured area to be treated. Make sure the volume of water is sufficient to completely suspend the VELPAR® DF.

TANK MIXTURES

VELPAR® DF herbicide may be tank mixed with other herbicides and /or adjuvants registered for the uses (crops) specified in the label.

Refer to the label of the tank mix partner(s) for any additional use instructions or restrictions.

RESISTANCE

When herbicides that affect the same biological site of action are used repeatedly over several years to control the same weed species in the same field, naturally-occurring resistant biotypes may survive a correctly applied herbicide treatment, propagate, and become dominant in that field. Adequate control of these resistant weed biotypes cannot be expected. If weed control is unsatisfactory, it may be necessary to retreat the problem area using a product affecting a different site of action.

To better manage herbicide resistance through delaying the proliferation and possible dominance of herbicide resistant weed biotypes, it may be necessary to change cultural practices within and between crop seasons such as using a combination of tillage, retreatment, tank-mix partners and/or sequential herbicide applications that have a different site of action. Weed escapes that are allowed to go to seed will promote the spread of resistant biotypes.

It is advisable to keep accurate records of pesticides applied to individual fields to help obtain information on the spread and dispersal of resistant biotypes. Consult your agricultural dealer, consultant, applicator, and/or appropriate state agricultural extension service representative for specific alternative cultural practices or herbicide recommendations available in your area.

INTEGRATED PEST MANAGEMENT

This product may be used as part of an Integrated Pest Management (IPM) program that can include biological, cultural, and genetic practices aimed at preventing economic pest damage. IPM principles and practices include field scouting or other detection methods, correct target pest identification, population monitoring, and treating when target pest populations reach locally determined action thresholds. Consult your state cooperative extension service, professional consultants or other qualified authorities to determine appropriate action treatment threshold levels for treating specific pest/crop systems in your area.

DIRECTIONS FOR USE

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

DuPont™ VELPAR® DF should be used only in accordance with recommendations on this label, or in supplemental DuPont labeling.

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.

The correct use rates by crop and geographical area, specified on the label, and proper mixing/loading site considerations and application procedures must be followed to minimize potential for hexazinone movement into ground water. Users are encouraged to consult with their state Department of Agriculture, Extension Service, or other pesticide lead agency for information regarding soil permeability, aquifer vulnerability, and best management practices for their area.

AGRICULTURAL USES

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 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.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 48 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
- Protective eyewear

ALFALFA

VELPAR® DF is recommended for control of certain weeds in established alfalfa grown for hay.

- Do not apply within 30 days of harvest (cutting for hay), or feeding of forage or grazing.
- Do not exceed 2 pounds per acre per application.
- Do not exceed 2 pounds (1.5 pounds active ingredient hexazinone) per acre per year.

APPLICATION INFORMATION

NON-DORMANT AND SEMI-DORMANT VARIETIES

In the following states, make a single application of VELPAR® DF during the winter months when alfalfa plants are in the least active stage of growth.

Arizona	Montana	Oklahoma	Washington
California	Nebraska	Oregon	Wyoming
Colorado	Nevada	South Dakota	
Idaho	New Mexico	Texas	
Kansas	North Dakota	Utah	

In the following states, make a single application of VELPAR® DF either in the spring before new growth exceeds 2 inches in height or to alfalfa stubble after cutting, following hay removal and before regrowth exceeds 2 inches in height.

Connecticut	Maine	New Hampshire	Vermont
Delaware	Maryland	New Jersey	Virginia
Illinois	Massachusetts	New York	West Virginia
Indiana	Michigan	Ohio	Wisconsin
Iowa	Minnesota	Pennsylvania	
Kentucky	Missouri	Rhode Island	

NOTE: Severe alfalfa injury may result following application, if after cutting the regrowth is more than 2

inches high, or there is significant stubble left after cutting or grazing, or the air temperature is above 90 °F.

DORMANT VARIETIES

Make a single application of DuPont™ VELPAR® DF after alfalfa becomes dormant and before new growth exceeds 2 inches in height in the spring. Where weeds have emerged, use a surfactant.

USE RATES

Use higher rates on hard-to-control species, (see **Weeds Controlled** section below) fine textured soils, soils containing greater than 5% organic matter, or under adverse environmental conditions such as temperature extremes or when weeds are stressed due to low rainfall.

For dormant alfalfa, use a surfactant approved for crops at the rate of 0.25% v/v (1 quart per 100 gallons of spray solution).

Select the appropriate rate for soil texture and organic matter content as follows:

Soils	VELPAR® DF (Lb/Acre)		
	Percent Organic Matter in Soil		
	<1%	1-5%	>5%
Coarse Texture			
Loamy sand, sandy loam	2/3 - 1	2/3 - 1	1 1/3 - 2
Medium Texture			
Loam, silt loam, silt, clay loam, sandy clay loam	2/3 - 1	1 - 2	1 1/3 - 2
Fine Texture			
Silty clay loam, sandy clay, silty clay, clay	1 - 2	1 - 2	1 1/3 - 2

NOTE:

- In the states of MT, ND, SD, and WY, do not exceed a use rate of 1 1/3 pounds per acre on medium and fine textured soils.
- In the state of Montana (MT), do not apply to soils with less than 1.5% organic matter.
- In the state of Wyoming (WY):
Do not apply to soils with less than 0.5% organic matter.
Apply to irrigated alfalfa only.

WEEDS CONTROLLED

VELPAR® DF, when applied preemergence or early postemergence at the following rates, is recommended for the control or suppression of the following species in alfalfa crops:

1/3 - 2/3 Lb/Acre

Tansymustard *Descurainia pinnata*

2/3 - 1 1/3 Lb/Acre

Bluegrass, annual	<i>Poa annua</i>
Brome, downy (cheatgrass)	<i>Bromus tectorum</i>
Buckwheat, wild	<i>Polygonum convolvulus</i>
Catchfly, English	<i>Silene gallica</i>
Chamomile, mayweed (dogfennel)	<i>Anthemis cotula</i>
Chickweed, common	<i>Stellaria media</i>
Fiddleneck, tarweed	<i>Amsinckia lycopsoides</i>
Filaree	<i>Erodium sp.</i>
Flixweed	<i>Descurainia Sophia</i>
Groundsel, common	<i>Senecio vulgaris</i>
Henbit*	<i>Lamium amplexicaule</i>
Lettuce, Miner's	<i>Montia perfoliata</i>
Mustard, blue	<i>Chorispora tenella</i>
Mustard, Jim Hill (tumble)	<i>Sisymbrium altissimum</i>
Mustard, wild	<i>Brassica kaber</i>
Orchardgrass (seedling)	<i>Dactylis glomerata</i>
Pennycress, field	<i>Thlaspi arvense</i>
Pigweed, redroot	<i>Amaranthus retroflexus</i>
Radish, wild	<i>Raphanus raphanistrum</i>
Rocket, London	<i>Sisymbrium irio</i>
Rocket, common yellow	<i>Barbarea vulgaris</i>
Salsify	<i>Tragopogon spp.</i>
Shepherdspurse	<i>Capsella bursa-pastoris</i>
Speedwell, purslane	<i>Veronica peregrina</i>
Spurry, corn	<i>Spergula arvensis</i>

1 1/3 - 2 Lb/Acre

Alfalfa* (seedling)	<i>Medicago sativa</i>
Barley, foxtail (seedling)	<i>Hordeum jubatum</i>
Bluegrass, perennial* (spring only)	<i>Poa spp</i>
Cockle, white*	<i>Melandrium album</i>
Dandelion, common*	<i>Taraxacum officinale</i>
Dandelion, false* (spotted catsear)	<i>Hypochaeris radicata</i>
Foxtail*	<i>Setaria spp</i>
Kochia	<i>Kochia scoparia</i>
Lambsquarters, common	<i>Chenopodium album</i>
Lettuce, prickly*	<i>Lactuca serriola</i>
Mallow, common	<i>Malva neglecta</i>
Ryegrass, Italian (annual)	<i>Lolium multiflorum</i>
Quackgrass*	<i>Elytrigia repens</i>
Speedwell, ivyleaf	<i>Veronica hederifolia</i>
Tea, Mexican*	<i>Chenopodium ambrosioides</i>
Thistle, Canada (seedling)	<i>Cirsium arvense</i>
Thistle, Russian	<i>Salsola iberica</i>

* Suppression - a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

VELPAR® DF, when applied in late spring or after cutting at the following rates, will control these species listed below:

2/3 - 2 Lb/Acre

Crabgrass	<i>Digitaria spp</i>
Fleabane	<i>Conyza spp</i>
Foxtail	<i>Setaria spp.</i>
Jimsonweed	<i>Datura stramonium</i>
Lambsquarters, common	<i>Chenopodium album</i>
Pigweed, redroot	<i>Amaranthus retroflexus</i>

SPRAY EQUIPMENT

Apply VELPAR® DF using a fixed boom power sprayer or aerial equipment.

For ground applications apply in a minimum of 20 gallons of spray solution per acre and by air in a minimum of 5 gallons.

CHEMIGATION

ALFALFA

Apply this product only through center pivot sprinkler irrigation systems. Do not apply this product through any other type of irrigation system.

Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from nonuniform distribution of treated water.

Severe alfalfa injury may result following application after cutting if either the regrowth is more than 2" high or significant stubble is left after alfalfa cutting.

If you have questions about calibration, you should contact State Extension Service specialists, equipment manufacturers or other experts.

A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

DORMANT APPLICATIONS

Select the appropriate rate (see **Use Rates** section) for soil texture and organic matter content using 0.25" to 0.75" of sprinkler irrigation as a continuous injection during the application. Best results are obtained when soil is moist at time of application, and when weeds have not germinated or are less than 2" tall or across.

APPLICATION AFTER CUTTING

Apply DuPont™ VELPAR® DF at 5.3 ounces per acre to stubble after cutting, following hay removal, and before regrowth exceeds 2" in height. Apply VELPAR® DF using 0.25" to 0.75" of sprinkler irrigation as a continuous injection during the application. Best results are obtained when soil is moist at time of application and when weeds have not germinated or are less than 2" tall or across.

NOTE: Making an application when daily temperatures are forecast to be in the mid-to-high 90 degree range within 3 to 5 days after treatment may increase the potential for crop injury.

SPRINKLER CHEMIGATION

The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from backflow.

The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.

The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.

The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.

The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.

Systems must use a metering pump, such as a positive

displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

MIXING INSTRUCTIONS

1. Fill the supply tank 1/4 to 1/3 full of water.
2. While agitating, add the required amount of VELPAR® DF and continue agitation until the VELPAR® DF is fully dispersed, at least 5 minutes.
3. Once the VELPAR® DF is fully dispersed, maintain agitation and continue filling tank with water. VELPAR® DF should be thoroughly mixed with water before adding any other material.
4. As the tank is filling, add tank mix partners (if desired). Follow use precautions and directions on the tank mix partner label.
5. After thorough mixing, the agitation system can be stopped to prevent excessive foaming in the tank. Once thoroughly mixed the solution in the supply tank does not require additional agitation unless specified on the companion products label. If foaming occurs in the injection supply tank, a defoaming agent (defoamer) may be added.
6. Apply VELPAR® DF spray mixture within 48 hours of mixing to avoid product degradation.

USE PRECAUTIONS - CHEMIGATION

- Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label prescribed safety devices for public water systems are in place.
- Distributing treated water in an uneven manner can result in crop injury, lack of effectiveness, or over-tolerance pesticide residues in the crop. Therefore, to ensure that the mixture is applied evenly at the recommended rate, use sufficient water, apply the mixture for the proper length of time and ensure sprinkler produces a uniform water pattern.
- Do not permit run-off during chemigation.

POSTING OF AREAS TO BE TREATED

Posting of areas to be chemigated is required when 1) any part of a treated area is within 300 feet of sensitive areas such as residential areas, labor camps, businesses, daycare centers, hospitals, in-patient clinics, nursing homes, or any public areas such as schools, parks, playgrounds, or other public facilities not including public roads, or 2) when the chemigated area is open to the public such as golf courses or retail greenhouses.

Posting must conform to all the following requirements:

- Treated areas shall be posted with signs at all usual points of entry and along likely routes of approach from the listed sensitive areas. When there are no usual points of entry, signs must be posted in the corners of the treated areas and in any other location affording maximum visibility to sensitive areas.
- The printed side of the sign should face away from the treated area towards the sensitive area. The signs shall be printed in English. Signs must be posted prior to application and must remain posted until foliage has dried

and soil surface water has disappeared. Signs may remain in place indefinitely as long as they are composed of materials to prevent deterioration and maintain legibility for the duration of the posting period.

- All words shall consist of letters at least 2 1/2 inches tall, and all letters and the symbol shall be a color which sharply contrasts with their immediate background. At the top of the sign shall be the words “KEEP OUT”, followed by an octagonal stop sign symbol at least 8 inches in diameter containing the word “STOP”. Below the symbol shall be the words “PESTICIDE IN IRRIGATION WATER”.
- Posting required for chemigation does not replace other posting and reentry requirements for farm worker safety.

REPLANTING (FOLLOWING ALFALFA)

- Do not replant treated areas to any crop except corn, root crops or sugarcane within two years after treatment, as crop injury may result.
- Corn may be planted 12 months after the last treatment in areas of moderate to high rainfall (greater than 20 inches), provided the use rate did not exceed 1 lb per acre.
- Root crops such as potatoes, sugarbeets, radish and carrots may be planted 12 months after last treatment, provided the use rate does not exceed 2/3 lb per acre. Sites with use rates higher than 2/3 lb per acre should not be replanted to any root crop within 2 years after application of DuPont™ VELPAR® DF, or unacceptable crop injury may result.

In areas where irrigation is needed to produce the crop, the crop rotation intervals listed may need to be extended if the normal irrigation amount is reduced for any reason.

- Sugarcane may be planted any time following treatment.
- In California, do not replant seed alfalfa areas to any crop within two years after treatment, as crop injury may result.

FLOOD IRRIGATED ALFALFA

In arid climates (10 inches of rainfall or less per year) or areas where drought conditions have prevailed for one or more years, a field bioassay should be completed prior to planting any desired crop. The results of this bioassay may require the rotation intervals listed above to be extended.

A successful bioassay means growing to maturity a test strip of the crop(s) intended for production. The test crop(s) strip should cross the entire field including knolls, low areas, and areas where any berms were located.

ALFALFA - IMPREGNATION ON DRY BULK FERTILIZER (EXCEPT CALIFORNIA AND ARIZONA)

Dry bulk fertilizer may be impregnated or coated with VELPAR® DF for application to established alfalfa. All recommendations on this label must be followed along with state regulations relating to dry bulk fertilizer blending, impregnating and labeling.

If fertilizer materials are excessively dusty, use a suitable additive to reduce dust prior to impregnation, as dusty fertilizer will result in poor distribution during application. The dry

fertilizer must be properly impregnated and uniformly applied to the alfalfa to avoid crop injury and/or poor weed control.

To impregnate the fertilizer, use a system consisting of a conveyor or closed drum used to blend dry bulk fertilizer. Any commonly used fertilizer can be impregnated with VELPAR® DF, except potassium nitrate or sodium nitrate. Do not use VELPAR® DF on limestone.

Use a minimum of 250 lb dry bulk fertilizer per acre and up to a maximum of 450 lb per acre. To impregnate or coat the dry bulk fertilizer with VELPAR® DF, mix 2 2/3 pounds of VELPAR® DF with sufficient water to make one gallon of suspension and thoroughly agitate. Direct the nozzles to deliver a fine spray of this suspension toward the fertilizer for thorough coverage while avoiding spray contact with mixing equipment. Uniform impregnation of VELPAR® DF to dry bulk fertilizer will vary, and if the absorptivity is not adequate, the use of an absorptive powder may be required to produce a dry, free-flowing mixture. “Microcel E” is the recommended absorbent powder. When another herbicide is used with VELPAR® DF, mix and impregnate the fertilizer immediately.

Apply impregnated fertilizer as soon as possible after impregnation for optimum performance.

Select the rate of VELPAR® DF to apply per acre from the appropriate section of this label. Then refer to the rate chart below to determine the amount of VELPAR® DF that should be impregnated on a ton of dry bulk fertilizer, based on the amount of fertilizer to be distributed in one acre.

Rate Chart for Impregnating Fertilizer with VELPAR® DF

Fertilizer Rate/Acre	VELPAR® DF Rate Per Acre			
	2/3 Lbs	1 Lbs	1 1/3 Lbs	2 Lbs
250 lbs	5.3 lbs/ton	8.0 lbs/ton	10.6 lbs/ton	16.0 lbs/ton
300 lbs	4.4 lbs/ton	6.6 lbs/ton	8.8 lbs/ton	13.3 lbs/ton
350 lbs	3.7 lbs/ton	5.7 lbs/ton	7.5 lbs/ton	11.4 lbs/ton
400 lbs	3.3 lbs/ton	5.0 lbs/ton	6.7 lbs/ton	10.0 lbs/ton
450 lbs	2.9 lbs/ton	4.4 lbs/ton	5.9 lbs/ton	8.9 lbs/ton

For rates other than those listed, use the following formula to calculate the amounts of VELPAR® DF to be impregnated per ton of dry fertilizer.

$$\text{Lbs VELPAR® DF} \times \frac{1 \text{ Ton}}{\text{Per Acre}} = \frac{\text{Lbs VELPAR® DF}}{\text{Ton of Fertilizer}}$$

APPLICATION

Uniform application of VELPAR® DF-impregnated dry fertilizer is essential for satisfactory weed control. Accurate calibration of the application equipment is essential for uniform distribution to the surface. The recommended method of application is to apply 1/2 the recommended rate and overlap 50%. This results in the best distribution pattern.

USE PRECAUTIONS - ALFALFA

- Best results are obtained when 1/2–1 inches of rainfall or sprinkler irrigation occurs within two weeks after application, when soil is moist at time of application, and when weeds have not germinated or are less than 2 inches in height or diameter. Heavy rainfall or excessive irrigation

after application may result in crop injury or poor performance of the herbicide.

- On soils high in organic matter (greater than 5%), the effectiveness of DuPont™ VELPAR® DF can be significantly reduced and weed control may be unsatisfactory.
- Avoid overlapping of spray swaths and shut off spray booms while starting, turning, slowing or stopping or crop injury may result.
- Crop injury, including mortality, may result in fields with restricted root growth due to non-uniform soil profiles such as gravel bases and clay lenses.
- Crop injury may result if hot weather, mid-to-high 90 degree range or higher, occurs within a few days after application.
- Do not apply to snow-covered or frozen ground.
- Since the effect of VELPAR® DF on alfalfa varies with soil conditions, uniformity of application, and environmental conditions, growers should limit their first use to small areas.
- If abnormally dry conditions exist following application, restrict the first irrigation to no more than 1/2 acre inch of water.
- Temporary yellowing of alfalfa may occur following VELPAR® DF applications.
- Treat only stands of alfalfa established for one year or for one growing season (except in California), provided:
 - The alfalfa stand has a well developed tap root structure that is at least 10 inches in length (0.25 inch diameter below the crown) throughout the field and the crop is healthy, vigorous, and not under stress from weather conditions, low fertility, insects or disease damage.
 - In areas with shorter growing seasons, such as, higher elevations, adequate alfalfa tap root growth may not occur and especially when alfalfa is grown together with a cover or nurse crop. If an adequate tap root is not present, delay application of VELPAR® DF until the alfalfa has gone through a minimum of two growing seasons.
- In California, fall planted alfalfa may be treated in the following winter months with VELPAR® DF at 1/3 to 2/3 pounds per acre (use higher rate for fine textured soils) provided:
 - alfalfa root growth exceeds 6 inches in length
 - vegetative top growth of alfalfa has lateral development of secondary growth
 - alfalfa is healthy and vigorous, not growing under stress from insect, disease, winter injury or other types of stress.
 Injury may result to alfalfa plants that fail to meet these growth criterion listed above.
- Do not use VELPAR® DF on seedling alfalfa, alfalfa-grass mixtures, or other mixed stands as injury may result to the seedling alfalfa or companion crop.
- Do not use a surfactant with VELPAR® DF when treating non-dormant alfalfa.

- Do not use VELPAR® DF on gravelly or rocky soils, exposed subsoils, hardpan, sand, poorly drained soil, or alkali soils.

SEED ALFALFA (CA, ID, MT, NV, OR, UT, WA) ADDITIONAL USE PRECAUTIONS

- Do not use VELPAR® DF on fields with sandy loam or loamy sand soils having less than 1% organic matter.
- Do not exceed 2/3 pound per acre on fields with sandy loam or loamy sand soils having 1–2% organic matter.
- Do not exceed 2/3 pound per acre on seed alfalfa that has been established for only one growing season.

BLUEBERRY

HIGH BUSH BLUEBERRIES

VELPAR® DF is recommended for control of certain herbaceous and woody weeds in established high bush blueberry fields.

APPLICATION INFORMATION

VELPAR® DF may be applied to high bush blueberries that have been established for 3 or more years. Apply VELPAR® DF in the spring before the lower leaves of the blueberry plant have fully expanded. Avoid contact of the leaves with the spray solution.

Using calibrated ground spray equipment, make the application in sufficient water to provide thorough and uniform coverage to the treated area (usually 20 gallons per acre). Shut off spray booms when starting, turning, slowing or stopping, or injury to the crop may result.

USE PRECAUTIONS

- Do not apply through any type of irrigation system.
- Do not apply within 90 days of harvest.
- Do not apply to flooded field with standing water.
- Application to blueberry foliage will result in crop injury.
- Since the effect of VELPAR® DF on blueberries varies with soil type, plant vigor, uniformity of applications and amount of rainfall, it is suggested that growers limit their first use to small areas.

USE RATES (Lbs/Acre) HIGH BUSH BLUEBERRIES

Soil texture	less than or equal to 3% organic matter	greater than 3% organic matter
Coarse loamy sand, sandy loam (50-85% sand)	1.3	1.6
Medium loam, silt loam, silt, clay loam, sandy clay loam		2.6
Fine silty clay loam, clay loam, sandy clay, silty clay, clay	1.3 - 2*	2.6

*Use the higher rate as the soil organic matter approaches 3%.

LOW BUSH BLUEBERRIES

DuPont™ VELPAR® DF may be used for the control of certain weeds in low bush blueberries.

APPLICATION INFORMATION

VELPAR® DF may only be applied to pruned blueberry fields in the spring before leaf emergence. Using calibrated ground spray equipment, make the application in sufficient water to provide thorough and uniform coverage to the treated area (usually 20 gallons per acre). Shut off spray booms when starting, turning, slowing or stopping, or injury to the crop may result.

LOW BUSH BLUEBERRIES (LBS/ACRE)

Soil texture	less than or equal to 3% organic matter	greater than 3% organic matter
Coarse loamy sand, sandy loam (50-85% sand)	1.2	1.6
Medium loam, silt loam, silt, clay loam, sandy clay loam		2
Fine silty clay loam, clay loam, sandy clay, silty clay, clay	1.2 - 2.4*	2.4 - 3.6**

*Use the higher rate as the soil organic matter approaches 3%.

**Use the higher rate for harder to control species.

USE PRECAUTIONS

- Do not apply through any type of irrigation system.
- Do not apply to flooded field with standing water.
- Do not apply within 450 days of harvest.
- Do not exceed 2.4 pounds per acre if field has been treated with hexazinone within the past 8 years.
- Application to blueberry foliage will result in crop injury.
- Since the effect of VELPAR® DF on blueberries varies with soil type, plant vigor, uniformity of applications and amount of rainfall, it is suggested that growers limit their first use to small areas. If excessive leaf drop is observed after treatment, reduce rate in future applications.
- Maintain a 50 foot buffer from any well head or water reservoir.

IMPREGNATION ON DRY BULK FERTILIZER

Dry bulk fertilizer may be impregnated or coated with VELPAR® DF for application to established blueberries. All recommendations on this label must be followed along with state regulations relating to dry bulk fertilizer blending, impregnating and labeling.

If fertilizer materials are excessively dusty, use a suitable additive to reduce dust prior to impregnation, as dusty fertilizer will result in poor distribution during application. The dry fertilizer must be properly impregnated and uniformly applied to the alfalfa to avoid crop injury and/or poor weed control.

To impregnate the fertilizer, use a system consisting of a conveyor or closed drum used to blend dry bulk fertilizer. Any commonly used fertilizer can be impregnated with VELPAR® DF, except potassium nitrate or sodium nitrate. Do not use VELPAR® DF on limestone.

Use a minimum of 250 lb dry bulk fertilizer per acre and up to a maximum of 450 lb per acre. To impregnate or coat the dry bulk fertilizer with VELPAR® DF, mix 2 2/3 pounds of VELPAR® DF with sufficient water to make one gallon of suspension and thoroughly agitate. Direct the nozzles to deliver a fine spray of this suspension toward the fertilizer for thorough coverage while avoiding spray contact with mixing equipment. Uniform impregnation of VELPAR® DF to dry bulk fertilizer will vary, and if the absorptivity is not adequate, the use of an absorptive powder may be required to produce a dry, free-flowing mixture. "Microcel E" is the recommended absorbent powder. When another herbicide is used with VELPAR® DF, mix and impregnate the fertilizer immediately.

Apply impregnated fertilizer as soon as possible after impregnation for optimum performance.

Select the rate of VELPAR® DF to apply per acre from the appropriate section of this label. Then refer to the rate chart below to determine the amount of VELPAR® DF that should be impregnated on a ton of dry bulk fertilizer, based on the amount of fertilizer to be distributed in one acre.

Rate Chart for Impregnating Fertilizer with VELPAR® DF

Fertilizer Rate/Acre	VELPAR® DF Rate Per Acre			
	2/3 Lbs	1 Lbs	1 1/3 Lbs	2 Lbs
250 lbs	5.3 lbs/ton	8.0 lbs/ton	10.6 lbs/ton	16.0 lbs/ton
300 lbs	4.4 lbs/ton	6.6 lbs/ton	8.8 lbs/ton	13.3 lbs/ton
350 lbs	3.7 lbs/ton	5.7 lbs/ton	7.5 lbs/ton	11.4 lbs/ton
400 lbs	3.3 lbs/ton	5.0 lbs/ton	6.7 lbs/ton	10.0 lbs/ton
450 lbs	2.9 lbs/ton	4.4 lbs/ton	5.9 lbs/ton	8.9 lbs/ton

For rates other than those listed, use the following formula to calculate the amounts of VELPAR® DF to be impregnated per ton of dry fertilizer.

$$\text{Lbs VELPAR® DF Per Acre} \times \text{1 Ton Fertilizer} = \text{Lbs VELPAR® DF per Ton of Fertilizer}$$

APPLICATION

Uniform application of VELPAR® DF-impregnated dry fertilizer is essential for satisfactory weed control. Accurate calibration of the application equipment is essential for uniform distribution to the surface. The recommended method of application is to apply 1/2 the recommended rate and overlap 50%. This results in the best distribution pattern.

WEEDS CONTROLLED

DuPont™ VELPAR® DF is recommended for the control or suppression of the following species in high and low bush blueberry crops:

Aster, heath*	<i>Aster ericoides</i>
Barnyardgrass	<i>Echinochloa crus-galli</i>
Blackberry* (briar)	<i>Rubus spp</i>
Bluegrass,	
Kentucky (perennial)*	<i>Poa pratensis</i>
Brome, downy (cheatgrass)	<i>Bromus tectorum</i>
Broomsedge*	<i>Andropogon virginicus</i>
Carrot, wild*	<i>Daucus carota</i>
Catchfly, English	<i>Silene gallica</i>
Chamomile, mayweed	<i>Anthemis cotula</i>
Cherry, wild	<i>Prunus serotia</i>
Chickweed, common	<i>Stellaria media</i>
Cinquefoil	<i>Potentilla spp</i>
Cockle, white*	<i>Melandrium album</i>
Dandelion, common*	<i>Taraxacum officinale</i>
Dandelion, false* (spotted catsear)	<i>Hypochaeris radicata</i>
Daisy, oxeye	<i>Chrysanthemum leucanthemum</i>
Dock, curly*	<i>Rumex crispus</i>
Dogfennel	<i>Eupatorium capillifolium</i>
Fescue*	<i>Festuca spp</i>
Fiddleneck, tarweed	<i>Amsinckia lycopsoides</i>
Filaree	<i>Erodium spp</i>
Fireweed*(willowweed)	<i>Epilobium angustifolium</i>
Fleabane, flax-leaved	<i>Conyza bonariensis</i>
Flixweed	<i>Descurainia Sophia</i>
Foxtail, yellow	<i>Setaria lutescens</i>
Goldenrod	<i>Solidago spp</i>
Groundsel, common	<i>Senecio vulgaris</i>
Hawkweed	<i>Hieracium spp</i>
Horseweed/marestail	<i>Conyza canadensis</i>
Jimsonweed	<i>Datura stramonium</i>
Lambsquarters, common	<i>Chenopodium album</i>
Lettuce, Miner's	<i>Montia perfoliata</i>
Lettuce, prickly*	<i>Lactuca serriola</i>
Mustard, blue	<i>Chorispora tenella</i>
Mustard, Jim Hill (tumble)	<i>Sisymbrium altissimum</i>
Orchardgrass *	<i>Dactylis glomerata</i>
Orchardgrass (seedling)	<i>Dactylis glomerata</i>
Panicgrass (witchgrass)	<i>Panicum capillare</i>
Panicum, fall	<i>Panicum dichotomiflorum</i>
Pearly everlasting	<i>Anaphalis margaritacea</i>
Pennycress, field	<i>Thlaspi arvense</i>
Pigweed, redroot	<i>Amaranthus retroflexus</i>
Quackgrass	<i>Agropyron repens</i>
Radish, wild	<i>Raphanus raphanistrum</i>
Ragweed, common	<i>Ambrosia elatior</i>
Raspberry* (briar)	<i>Rubus spp</i>
Rocket, London	<i>Sisymbrium irio</i>
Rocket, common yellow	<i>Barbarea vulgaris</i>
Ryegrass, Italian (annual)	<i>Lolium multiflorum</i>
Ryegrass, perennial*	<i>Lolium perenne</i>
Salsify	<i>Tragopogon spp</i>
Shepherdspurse	<i>Capsella bursa-pastoris</i>
Smartweed, Pennsylvania	<i>Polygonum pensylvanicum</i>
Sorrel, red	<i>Rumex acetosella</i>
Sorrel, sheep	<i>Rumex angiocarpus</i>
Spurry, corn	<i>Spergula arvensis</i>
Strawberry, wild	<i>Fragaria virginiana</i>
Tansymustard (pinnate)	<i>Descurainia pinnata</i>
Tea, Mexican*	<i>Chenopodium ambrosioides</i>
Velvetgrass	<i>Holcus lanatus</i>
Yarrow	<i>Achillea spp</i>

2.4 to 3.6 Lbs/acre

Dogbane**	<i>Apocynum spp</i>
Meadow-sweet	<i>Filipendula ulmaria</i>
Blackberry, trailing	<i>Rubus ursinus</i>
Laurel, sheep	<i>Kalmia angustifolia</i>
Rose, wild**	<i>Rosa spp</i>

* Suppression – a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

** Harder to control species.

CHRISTMAS TREES

VELPAR® DF is recommended for control of certain weeds where the following species are grown:

Fir, Douglas (western US only)	<i>Pseudotsuga menziesii</i>
Fir, Fraser	<i>Abies fraseri</i>
Fir, grand	<i>Abies grandis</i>
Fir, noble	<i>Abies procera</i>
Pine, Austrian	<i>Pinus nigra</i>
Pine, loblolly	<i>Pinus taeda</i>
Pine, ponderosa	<i>Pinus ponderosa</i>
Pine, Scotch	<i>Pinus sylvestris</i>
Spruce, Sitka	<i>Picea sitchensis</i>

Unless otherwise directed in separately published DuPont recommendations, do not use VELPAR® DF on Christmas trees in the following states:

Alabama	Louisiana	New Jersey	Texas
Arkansas	Maine	New York	Vermont
Connecticut	Maryland	North Carolina	Virginia
Delaware	Massachusetts	Pennsylvania	West Virginia
Georgia	Mississippi	Rhode Island	
Florida	New Hampshire	South Carolina	

APPLICATION INFORMATION

EASTERN US

Apply VELPAR® DF as a broadcast spray in the spring prior to bud break. If application is made after bud break, use directional spray equipment to prevent contact with foliage.

WESTERN US

Areas of greater than 20 inches annual rainfall - VELPAR® DF may be applied as a broadcast spray in the spring prior to conifer bud break. If application is made after bud break, use directional spray equipment to prevent contact with foliage.

Areas of less than 20 inches annual rainfall - VELPAR® DF may be applied in the fall before the soil freezes or in the spring after snow cover melts, but before conifer bud break occurs.

USE RATES

The rates listed below are for broadcast application. For band application, use proportionately less; for example, use 1/2 of the broadcast rates when treating a 3-foot band where row spacing is 6 feet. Use the higher end of the rate range on the heavier soil type.

Do not use more than one application of VELPAR® DF per year.

Soils	VELPAR® DF (Lb/Acre)	
	First Year Plantings	Established Trees
Coarse Texture		
Loamy sand, sandy loam (50-85% sand)	1 1/3	1 1/3 - 1 2/3
Medium Texture		
Loam, silt loam, silt, clay loam, sandy clay loam	1 1/3 - 1 2/3	1 2/3 - 2 1/3
Fine Texture		
Silty clay loam, clay loam, sandy clay, silty clay, clay	1 2/3 - 2	2 1/3 - 2 2/3

First year plantings - Transplant stock that is 2 years old or more (1 year old for loblolly pine). Apply DuPont™ VELPAR® DF only if rainfall has settled the soil around the base and root systems of the transplants.

Established trees - Trees that have been planted in the plantation for 1 year or more.

WEEDS CONTROLLED

VELPAR® DF is recommended for the control or suppression of the following weed species in Christmas tree crops:

Aster, heath*	<i>Aster ericoides</i>
Barnyardgrass	<i>Echinochloa crus-galli</i>
Bentgrass, common	<i>Agrostis alba</i>
Bluegrass, annual	<i>Poa annua</i>
Bromegrass	<i>Bromus spp</i>
Burnweed, American*	<i>Erechtites hieracifolius</i>
Carrot, wild	<i>Daucus carota</i>
Crabgrass*	<i>Digitaria spp</i>
Curly dock*	<i>Rumex crispus</i>
Daisy, oxeye	<i>Chrysanthemum leucanthemum</i>
Dandelion, common*	<i>Taraxacum officinale</i>
Dandelion, false* (spotted catsear)	<i>Hypochaeris radicata</i>
Fescue*	<i>Festuca spp</i>
Fleabane	<i>Conyza spp</i>
Foxtail	<i>Setaria spp</i>
Goldenrod*	<i>Solidago spp</i>
Groundsel, common	<i>Senecio vulgaris</i>
Horseweed/maretail	<i>Conyza canadensis</i>
Orchardgrass *	<i>Dactylis glomerata</i>
Ragweed, common	<i>Ambrosia elatior</i>
Ryegrass, Italian (annual)	<i>Lolium multiflorum</i>
Ryegrass, perennial*	<i>Lolium perenne</i>
Smartweed, Pennsylvania	<i>Polygonum pennsylvanicum</i>
Velvetgrass, common	<i>Holcus lanatus</i>

* Suppression – a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

SPRAY EQUIPMENT

VELPAR® DF may be applied by ground equipment or by air.

Select a spray volume that will ensure a thorough and uniform application. Apply a minimum of 5 gallons per acre by air and a minimum of 10 gallons per acre by ground equipment.

USE PRECAUTIONS CHRISTMAS TREES

- Do not use VELPAR® DF in nurseries, seed beds, or ornamental plantings.
- Do not add a surfactant in applications over the top of conifers.
- Weed control results from spring applications depend on sufficient moisture to activate VELPAR® DF.
- Do not cut treated vegetation for forage or hay nor graze domestic animals on treated areas for 60 days following application.
- Poor weed and brush control may result from the following:
 - Heavy duff or slash present at the time of application.
 - Use on poorly drained sites.
 - Applications made when soil is saturated with water and rain is imminent within 24 hours.

–Applications to soils high in organic matter (greater than 5%).

- Injury may occur when VELPAR® DF is used on the following:

–Trees that show poor vigor, insect damage, disease, winter injury, or other stress conditions.

–Any soil containing less than 1% organic matter.

–Loamy sand or sandy loam with less than 2% organic matter (except Jeffrey Pine and Ponderosa Pine).

–Foliage after bud break.

–Gravelly or rocky soils, exposed subsoils, clay knobs, sand, or sandy soil with 85% or more sand.

PINEAPPLE

VELPAR® DF is recommended for control of certain weeds in pineapple.

APPLICATION INFORMATION

Mix the proper amount of VELPAR® DF in water. Add a surfactant at the rate of 0.25% V/V.

Use the lower rates on coarse-textured soils or in areas where rainfall exceeds 65 inches per year. Use the higher rates on fine-textured soils or in areas where rainfall is less than 65 inches per year.

Intercrop period - Apply VELPAR® DF as a broadcast spray in 100–400 gallons of water per acre at the rate of 1/3 - 2 1/3 pounds per acre. For aerial application, use at least 10 gal water per acre.

Post mulch, preplant - Apply VELPAR® DF as a broadcast spray in 100–400 gallons of water per acre at the rate of 1/3 - 2 1/3 pounds per acre.

Post plant, before planted cuttings start active growth - Apply VELPAR® DF as a broadcast spray in 100–400 gallons of water per acre at the rate of 1/3 - 2 1/3 pounds per acre. A post-plant application should be made after planted cuttings start to grow only when weed growth has escaped control by other herbicide applications.

Prior to forcing first ratoon - Apply VELPAR® DF as a broadcast spray in 100–400 gallons of water per acre at the rate of 1/3 - 2 1/3 pounds per acre.

Directed postemergence (pineapple and weeds) inter-space application - Apply VELPAR® DF as a directed spray 3–10 months after planting in 50–200 gallons of water per acre (broadcast basis) at the rate of 1/3 - 2 1/3 pounds per acre (broadcast basis) using a stroller boom or knapsack.

Directed spot treatments for perennial grasses before floral induction - Spray perennial grasses postemergence to wet (50–200 gallons per acre depending on size) with 1 1/3 - 2 1/3 pounds per 100 gallons of water as a spot treatment.

Treatments to field edges and roadsides - Apply VELPAR® DF at 2 1/3 - 4 8/10 pounds per acre in 100–400 gallons of water.

WEEDS CONTROLLED

DuPont™ VELPAR® DF is recommended for the control or suppression of the following species in pineapple crops:

Ageratum, tropic	<i>Ageratum conyzoides</i>
Balsamapple	<i>Momordica charantia</i>
Castorbean	<i>Ricinus communis</i>
Crabgrass	<i>Digitaria spp</i>
Crotalaria	<i>Crotalaria spp</i>
Dallisgrass	<i>Paspalum dilatatum</i>
Guineagrass	<i>Panicum maximum</i>
Junglerice	<i>Echinochloa colonum</i>
Kao haole*	<i>Leucaena glauca</i>
Moana loa vine*	<i>Canavalia cathartica</i>
Morningglory	<i>Ipomoea spp</i>
Oxalis	<i>Oxalis spp</i>
Popolo	<i>Solanum sandwicense</i>
Richardsonium	<i>Richardsonia spp</i>
Vaseygrass	<i>Paspalum urvillei</i>

* Suppression – a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

USE PRECAUTIONS - PINEAPPLE

- Do not exceed 4.8 lb VELPAR® DF per acre per crop.
- Do not apply VELPAR® DF within 181 days of harvest.

SUGARCANE

VELPAR® DF is recommended for selective weed control in sugarcane except in the State of Florida.

APPLICATION INFORMATION

Apply a single treatment of VELPAR® DF per year using a fixed-boom sprayer and a minimum of 25 gallons per acre unless otherwise directed.

HAWAII

Apply VELPAR® DF pre- or postemergence at the following rates for the indicated soil texture:

**DuPont™
VELPAR® DF (Lb/Acre)
(Plus surfactant
0.25% by volume)**

Soils	
Coarse Texture	
Sand, loamy sand, sandy loam	2/3 - 1 2/10
Medium Texture	
Loam, silt loam, silty clay loam	2/3 - 2 1/3
Fine Texture	
Clay, gray hydromorphic clay	2 1/3 - 4 8/10

Use the higher levels of the recommended dosage ranges on soils high in organic matter. Do not apply more than twice the highest recommended rate for the indicated soil texture per crop (18–24 months).

A surfactant is recommended for all uses.

For preemergence use only, VELPAR® DF may be applied with aerial equipment using at least 10 gallons of spray per acre.

Apply VELPAR® DF herbicide as a spot spray application for emerged weeds in sugarcane. Mix 1 to 4 pounds of VELPAR® DF per 100 gallons of water. Apply a sufficient volume of spray solution to thoroughly wet weed foliage but do not exceed a use rate of 4.8 pounds per acre. Use the lower concentrations on coarse-textured soils that are low in organic matter, and use the higher concentrations on fine-textured soils that are high in organic matter.

LOUISIANA

Apply 2/3 - 1 2/10 pound of VELPAR® DF per acre broadcast in the fall before sugarcane emerges or in the spring before active cane tillering begins. Fall treatments of 2/3 - 1 2/10 pound per acre may be followed by a spring treatment of 2/3 - 1 2/10 pound per acre. Do not apply more than 2 pound per year. Use the lower rates on coarse textured soils and the higher rates on fine textured soils.

PUERTO RICO

For preemergence treatments, apply 1/3 - 2/3 pound of VELPAR® DF per acre.

For postemergence treatments, apply 1/3 - 2/3 pound of VELPAR® DF per acre to weeds after they have emerged. Use the lower rates on coarse-textured soils and the higher rates on fine-textured soils (high in clay or organic matter). Each ratoon may receive up to 2/3 pound of VELPAR® DF per acre.

For spot treatment of emerged weeds, VELPAR® DF may be applied with a knapsack sprayer in concentrations of 1/3 - 2/3 pound per 100 gallons of water. Apply a sufficient spray volume to wet the weed foliage. Do not exceed 100 gallons of spray per treated acre. Use the lower concentration on coarse-textured soils and the higher concentration on fine-textured soils.

Note: Since it is difficult to calibrate “spot” knapsack applications, extra care must be taken not to exceed the rate equivalent of the maximum of 2/3 pound VELPAR® DF per acre.

Do not apply more than 1 1/3 pound of VELPAR® DF per acre per crop season.

TEXAS

Apply 2/3 - 2 1/3 pound of VELPAR® DF per acre. On plant cane, apply the herbicide before the cane emerges or as a directed layby treatment. On stubble cane, apply VELPAR® DF preemergence (up to the 3-leaf stage) or as a directed layby treatment. A pre- or early postemergence treatment may be followed by a layby treatment, provided at least 60 days have elapsed and 3 inches of rainfall or sprinkler irrigation have occurred since the first treatment.

Do not apply more than 2 1/3 pound of VELPAR® DF per acre per season.

Use the following rates according to the different soil textures:

Soils	DuPont™ VELPAR® DF (Lb/Acre)	
	Preemergence	+ Layby
Coarse Texture*		
Sandy loam	1/3	1/3
Medium Texture		
Loam, silt loam	9/10	9/10
Fine Texture		
Clay loam	1 1/3	1 1/3

* With at least 2% organic matter

On dormant cane, a surfactant may be added to the spray mixture to increase control of emerged weeds.

WEEDS CONTROLLED

VELPAR® DF is recommended for the control or suppression of the following species in sugarcane crops:

Ageratum, tropic*	<i>Ageratum conyzoides</i>
Alexandergrass	<i>Brachiaria plantaginea</i>
Balsamapple	<i>Momordica charantia</i>
Barnyardgrass	<i>Echinochloa crus-galli</i>
Bermudagrass*	<i>Cynodon dactylon</i>
Burnweed, American (fireweed)	<i>Erechtites hieracifolius</i>
Chickweed, common	<i>Stellaria media</i>
Crabgrass, large	<i>Digitaria sanguinalis</i>
Crabgrass, smooth	<i>Digitaria ischaemum</i>
Crotalaria, fuzzy	<i>Crotalaria incana</i>
Crotalaria, showy	<i>Crotalaria spectabilis</i>
Cuphea, tarweed	<i>Cuphea carthagenensis</i>
Dallisgrass	<i>Paspalum dilatatum</i>
Fingergrass, radiate	<i>Chloris radiata</i>
Fingergrass, swollen	<i>Chloris barbata</i>
Foxtail, bristly	<i>Setaria verticillata</i>
Foxtail, yellow	<i>Setaria lutescens</i>
Geranium, Carolina	<i>Geranium carolinianum</i>
Goosegrass	<i>Elusine indica</i>
Guineagrass	<i>Panicum maximum</i>
Henbit	<i>Lamium amplexicaule</i>
Itchgrass*	<i>Rottboellia cochinchinensis</i>
Job's-tears	<i>Coix lacryma</i>
Johnsongrass (seedling)	<i>Sorghum halepense</i>
Junglerice	<i>Echinochloa colonum</i>
Lambsquarters, common	<i>Chenopodium album</i>
Millet, Texas	<i>Panicum texanum</i>
Morningglory, hairy	<i>Ipomoea pentaphylla</i>
Morningglory, threelobe	<i>Ipomoea triloba</i>
Mustard, wild	<i>Sinapis arvensis</i>
Oxalis	<i>Oxalis spp</i>
Paintbrush, Flora's	<i>Emilia sonchifolia</i>
Panicum, browntop	<i>Panicum fasciculatum</i>
Paspalum, ricegrass	<i>Paspalum orbiculare</i>
Paspalum, sour	<i>Paspalum conjugatum</i>
Pigweed, redroot	<i>Amaranthus retroflexus</i>
Pigweed, slender (green)	<i>Amaranthus viridis</i>
Pigweed, smooth	<i>Amaranthus chlorostachys</i>
Popolo	<i>Solanum sandwicense</i>
Purslane, common	<i>Portulaca oleracea</i>
Sandbur	<i>Cenchrus spp</i>
Sensitive plant (hila hila)	<i>Mimosa spp</i>
Signalgrass, broadleaf	<i>Brachiaria platyphylla</i>
Sowthistle, common	<i>Sonchus oleraceus</i>
Spanishneedles	<i>Bidens bipinnata</i>
Sprangletop	<i>Leptochloa spp</i>
Spurge, prostrate	<i>Euphorbia humistrata</i>
Spurge, graceful	<i>Chamaesyce hypericifolia</i>
Sunflower	<i>Helianthus spp</i>
Vaseygrass	<i>Paspalum urvillei</i>
Waltheria (hia loa)	<i>Waltheria spp</i>

* Suppression – a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

USE PRECAUTIONS - SUGARCANE

- Do not plant any crop other than sugarcane following an application of VELPAR® DF.
- Do not feed sugarcane forage to livestock.
- Do not apply VELPAR® DF:
 - Within 180 days of harvest in Hawaii.
 - Within 234 days of harvest in Louisiana.
 - Within 288 days of harvest in Puerto Rico.
 - Within 234 days of harvest in Texas.
- To avoid injury to sugarcane, observe the following precautions:
 - Do not use VELPAR® DF on cane that shows poor vigor because of insect damage, disease, or winter injury, or shows symptoms of other stress conditions such as drought stress.
 - Do not add a surfactant in applications unless otherwise specified.
 - Do not use VELPAR® DF on gravelly or rocky soils, thinly covered subsoils, or coarse-textured soils (sands to sandy loams) with less than 1% organic matter.
 - Temporary chlorosis of the crop may result from application over emerged cane. Applications during active cane growth should be directed to cover the weeds and soil while minimizing crop contact.
 - Do not use VELPAR® DF on varieties known to be susceptible to herbicides.
- Extremely heavy rainfall after application may result in poor weed control and/or crop injury, especially if the application is made to dry soil.

FORESTRY

SITE PREPARATION

VELPAR® DF is recommended for weed and brush control in areas where the following species are grown:

EASTERN US AND LAKE STATES

Fir, balsam	<i>Abies balsamea</i>
Pine, Austrian	<i>Pinus negra</i>
Pine, loblolly	<i>Pinus taeda</i>
Pine, longleaf	<i>Pinus palustris</i>
Pine, ponderosa	<i>Pinus ponderosa</i>
Pine, red	<i>Pinus resinosa</i>
Pine, Scotch	<i>Pinus sylvestris</i>
Pine, shortleaf	<i>Pinus echinata</i>
Pine, slash	<i>Pinus elliotii</i>
Pine, Virginia	<i>Pinus virginiana</i>
Spruce, black	<i>Picea mariana</i>
Spruce, red	<i>Picea rubens</i>
Spruce, white	<i>Picea glauca</i>

WESTERN US

Fir, Douglas	<i>Pseudotsuga menziesii</i>
Fir, grand	<i>Abies grandis</i>
Fir, Noble	<i>Abies procera</i>
Fir, white	<i>Abies concolor</i>
Pine, Jeffrey	<i>Pinus jeffreyi</i>
Pine, lodgepole	<i>Pinus contorta</i>
Pine, ponderosa	<i>Pinus ponderosa</i>
Spruce, blue	<i>Picea pungens</i>
Spruce, Engelman	<i>Picea englemanni</i>
Spruce, Sitka	<i>Picea sitchensis</i>

APPLICATION INFORMATION

EASTERN US

Apply DuPont™ VELPAR® DF from early spring to early summer after hardwoods have broken bud and before the foliage has hardened off.

VELPAR® DF (Lb/Acre)	
Soils	Eastern US
Coarse Texture	
Sand, loamy sand, sandy loam	2 2/3 - 4
Medium Texture	
Loam, silt loam, sandy clay loam	4 - 5 1/3
Fine Texture	
Silty clay loam, clay loam, sandy clay, silt, silty clay, clay	5 1/3 - 6 2/3

The rates listed are for broadcast application. Use the lower rates on coarse textured soils and soils low in organic matter. Use the higher rates on fine textured soils and soils high in organic matter. Use the higher rates where weeds identified with an * in the Weeds Controlled list predominate.

WESTERN US

For **SITE PREPARATION**, VELPAR® DF may be applied at 1.3 to 4 pounds per acre. Use the lower rates on coarse textured soils and soils low in organic matter. Use the higher rates on fine textured soils and soils high in organic matter. Use the higher rates where weeds identified in this label as “suppression” predominate.

In areas where other conifer species may be mixed in with the conifers listed above, VELPAR® DF may be applied if the user has prior experience with VELPAR® DF on the other conifer species. With no prior experience, it is recommended that either a small area of plantings be tested for conifer safety prior to treating larger areas, or make no application of VELPAR® DF in these areas within the site preparation area. Conifer species that are sensitive to VELPAR® (hexazinone) DF, such as, sugar pine and western larch, require 18 months before interplanting on treated sites.

Applications made to shelter wood sites may also result in mortality to over-story conifers. Factors that may influence conifer sensitivity in these sites could include application rate, conifer species, soil characteristics, uniformity of spray distribution across the treatment swath and environmental stress.

Rain Belt (areas of high spring rainfall): For best results, apply in late winter or spring when weeds and brush are actively growing.

Snow Belt (areas of low spring rainfall): For best results, apply in the fall before soil freezes, or in the spring after snow cover melts in anticipation of rainfall. Weed and brush control results from spring applications will be dependent on sufficient rainfall following application to activate VELPAR® DF.

PLANTS CONTROLLED

VELPAR® DF is recommended for the control or suppression of the following species in site preparations for forestry crops:

HERBACEOUS PLANTS

Asters	<i>Aster ericoides</i>
Aster, heath*	<i>Echinochloa crus-galli</i>
Barnyardgrass	<i>Agrostis spp</i>
Bentgrass	<i>Poa annua</i>
Bluegrass, annual	<i>Bromus spp</i>
Bromegrass	<i>Daucus carota</i>
Carrot, wild	<i>Digitaria spp</i>
Crabgrass*	<i>Chrysanthemum leucanthemum</i>
Daisy, oxeye	<i>Taraxacum officinale</i>
Dandelion, common*	
Dandelion, false* (spotted catsear)	<i>Hypochaeris radicata</i>
Dock, curly*	<i>Rumex crispus</i>
Elksedge	<i>Carex geeyeri</i>
Fescue*	<i>Festuca spp</i>
Fireweed*(willowweed)	<i>Epilobium angustifolium</i>
Fleabane	<i>Conyza spp</i>
Foxtail	<i>Setaria spp</i>
Goldenrod*	<i>Solidago spp</i>
Groundsel, common	<i>Senecio vulgaris</i>
Horseweed/marestail	<i>Conyza canadensis</i>
Mullein, common**	<i>Verbascum thapsus</i>
Orchardgrass *	<i>Dactylis glomerata</i>
Pinegrass	<i>Calamagrostis rubescens</i>
Quackgrass*	<i>Agropyron repens</i>
Ragweed, common	<i>Ambrosia elatior</i>
Ryegrass, Italian (annual)	<i>Lolium multiflorum</i>
Ryegrass, perennial*	<i>Lolium perenne</i>
Smartweed, Pennsylvania	<i>Polygonum pensylvanicum</i>
Squawcarpet	<i>Ceanothus prostratus</i>
Thistle, Canada*	<i>Cirsium arvense</i>
Velvetgrass, common	<i>Holcus lanatus</i>

** For western US site preparation, apply at 4 pounds per acre.

WOODY PLANTS

Ash	<i>Fraxinus spp</i>
Aspen, big tooth	<i>Populus grandidentata</i>
Aspen, trembling	<i>Populus tremuloides</i>
Birch	<i>Betula spp</i>
Blackgum	<i>Nyssa sylvatica</i>
Cherry, black	<i>Prunus serotina</i>
Deerbrush	<i>Ceanothus integerrimus</i>
Dogwood, flowering*	<i>Cornus florida</i>
Elm	<i>Ulmus spp</i>
Hawthorn	<i>Crataegus spp</i>
Hazel	<i>Corylus spp</i>
Hickory	<i>Carya spp</i>
Honeysuckle*	<i>Lonicera spp</i>
Manzanita, Greenleaf	<i>Arctostaphylos patula</i>
Maple, red*	<i>Acer rubrum</i>
Oaks	<i>Quercus spp</i>
Poplar, balsam	<i>Populus balsamifera</i>
Snowbrush (varnishleaf)	<i>Ceanothus velutinus</i>
Sourwood*	<i>Oxydendrum arboretum</i>
Sweetgum	<i>Liquidambar spp</i>
Willows	<i>Salix spp</i>

* Suppression is a visible reduction in plant competition (reduced population and/or vigor) as compared to an untreated area. Degree of suppression will vary with rate applied, size of plants at application and environmental conditions following treatment. Species indicated above, especially resprouts of these species, may require a follow up treatment for acceptable control. Burning, as a follow up treatment, will enhance control of resprouts.

Within several weeks after VELPAR® DF activation by rainfall, affected vegetation may be burned, if desired. This

burn may further enhance control of vegetation. Burn the vegetation only after any residual stand is completely defoliated, at least twice, allowing for sufficient root uptake of DuPont™ VELPAR® DF. In the West, results may take one to two years in areas of low rainfall.

SPRAY EQUIPMENT

When applied as a liquid spray using water as the carrier, VELPAR® DF may be applied by ground equipment or by air (helicopter only).

For ground application, use enough water for thorough coverage, usually a minimum of 25 gallons per acre. For aerial applications, use at least 5 gallons of water per acre.

GRID APPLICATION

Mix 2 2/3 pounds of VELPAR® DF with sufficient water to make one gallon of suspension and thoroughly agitate. Intermittent agitation may be required to maintain the VELPAR® DF in suspension.

Apply the VELPAR® DF suspension directly to the soil surface in a grid pattern using an exact delivery handgun applicator. This equipment delivers a thin stream of predetermined volume. VELPAR® DF should be applied during the period from hardwood bud break to early summer.

Application rate and grid pattern will depend on soil texture and woody plant composition. Use the lower rates on coarse textured soils and when the major component of the hardwoods are susceptible species. Use the high rates on fine-textured soils and where weeds identified in this label as “partial control or suppression” predominate.

Application Patterns and Rates For VELPAR® DF Suspension

	ML/Spot	Grid (Ft)	Lb/Acre
Coarse	0.6	3 X 3	2
	2.0	4 X 4	4
	3.1	4 X 6	4
Medium/Fine	1.6	3 X 3	5.3
	2.8	4 X 4	5.3
	3.5	4 X 4	6.6
	5.2	4 X 6	6.6

BASAL (SOIL) SINGLE STEM TREATMENTS

Mix 2 2/3 pounds of VELPAR® DF with sufficient water to make one gallon of suspension and thoroughly agitate. Apply the VELPAR® DF suspension with an exact-delivery handgun applicator. This equipment delivers a thin stream of predetermined volume when triggered. Apply the VELPAR® DF suspension at the rate of 2 to 4 ml for each inch of stem diameter at breast height. Direct the treatment to the soil within 3 feet of the root collar of woody plants to be controlled.

For multi-stemmed and low-growing brush that have stem diameters that are difficult to determine, apply the VELPAR® DF suspension at the rate of 2 to 4 ml per 3 feet of canopy width. For tall, slender (columnar) brush types, apply 4 to 8 ml per 3 feet of height. Base the rate on whichever canopy dimension is greater (width or height). Apply the lower volumes for coarse textured soils or soils with low organic matter soils and the higher volumes for fine textured soils or soils with high organic matter.

When treating brush that requires more than a single delivery of the VELPAR® DF suspension, apply subsequent deliveries equally spaced around the target plant. If treating brush on sloping sites, apply most of the suspension on the uphill side of the stem. If treating resprouts from brush disturbed by cutting or other mechanical methods, the rate of application should be proportional to the original tree size, not just the size of sprout regrowth.

USE PRECAUTIONS SITE PREPARATION

Where burning is desired, burn the vegetation only after any residual brush has completely defoliated, at least twice, allowing for sufficient root uptake of VELPAR® DF.

Following harvest, allow sufficient time for stumps and injured trees to adequately resprout before applying VELPAR® DF.

FORESTRY – RELEASE

VELPAR® DF is recommended for conifer release where the following species are grown:

EASTERN US AND LAKE STATES

Fir, balsam	<i>Abies balsamea</i>
Pine, loblolly	<i>Pinus taeda</i>
Pine, longleaf	<i>Pinus palustris</i>
Pine, red	<i>Pinus resinosa</i>
Pine, shortleaf	<i>Pinus echinata</i>
Pine, slash	<i>Pinus elliotii</i>
Pine, Virginia	<i>Pinus virginiana</i>
Spruce, black	<i>Picea mariana</i>
Spruce, Norway	<i>Picea abies</i>
Spruce, red	<i>Picea rubens</i>
Spruce, white	<i>Picea glauca</i>

WESTERN US

Fir, Douglas	<i>Pseudotsuga menziesii</i>
Fir, grand	<i>Abies grandis</i>
Fir, Noble	<i>Abies procera</i>
Fir, white	<i>Abies concolor</i>
Hemlock, Western	<i>Tsuga heterophylla</i>
Pine, Jeffrey	<i>Pinus jeffreyi</i>
Pine, lodgepole	<i>Pinus contorta</i>
Pine, ponderosa	<i>Pinus ponderosa</i>
Spruce, blue	<i>Picea pungens</i>
Spruce, Englemann	<i>Picea englemannii</i>
Spruce, Sitka	<i>Picea sitchensis</i>

APPLICATION INFORMATION

EASTERN US

Apply DuPont™ VELPAR® DF from early spring to early summer after hardwoods have broken bud and before full leaf expansion.

Applications made over the top of pines may result in excessive pine injury under conditions of high humidity and temperature (80 degrees F).

WESTERN US

Rainbelt (areas of high spring rainfall): For best results, apply in late winter or spring when brush is actively growing, but prior to conifer budbreak. If application is made after bud break, use directional spray equipment to prevent contact with conifer foliage, as injury may result.

Snowbelt (areas of low spring rainfall): For best results, apply in the fall before soil freezes and after the final resting bud has hardened on the conifers. Or, spring applications may be made after snow cover melts in anticipation of rainfall prior to conifer budbreak. Brush control results from spring treatments will be dependent on sufficient rainfall following application to activate VELPAR® DF.

USE RATES

The rates listed below are for broadcast application. Do not use more than one application of VELPAR® DF per year. Use the higher rate range for the harder to control* (suppression) species in the PLANTS CONTROLLED listings of the Site Prep and Release sections.

EASTERN US

Crop Species	Soil Description	VELPAR® DF (Lb/Acre)	Established Trees
Loblolly pine	Loamy sand,	1 1/3 - 2	
Longleaf pine	sandy loam		
Shortleaf pine	Loam, silt loam,	1 1/3 - 2 2/3	
Virginia pine	silt, sandy clay loam		
Slash pine	Silty clay loam, clay loam, sandy clay, silty clay, clay	3 - 4	
Red pine	Loamy sand, sandy loam	1 1/3 - 2 2/3	
	Loam, silt loam, silt, sandy clay loam	2 2/3 - 4	
	Silty clay loam, clay loam, sandy clay, silty clay, clay	4 - 5 1/3	

Established Trees

- 4 years of age from transplanting on coarse-textured soils
- 3 years of age from transplanting on medium-textured soils
- 2 years of age from transplanting for Red Pine

WESTERN US

Application rates by soil type for VELPAR® DF in the following western conifers: Blue spruce, Douglas fir, Engleman spruce, Grand fir, Jeffrey pine, Lodgepole pine, Noble fir, Ponderosa pine, Sitka spruce, Western hemlock and White fir.

Soil Description	VELPAR® DF (Lb/Acre)
Loamy sand, sandy loam	1 1/3 - 3
Loam, silt loam, sandy clay loam	2 2/3 - 4
Silt, silty clay loam, clay loam, sandy clay, silty clay, clay	3 - 4

For first year plantings utilizing bare root stock, treat only transplant stock that is 2 years old (2-0, 1-1) or more, except (1-0) for Ponderosa and Jeffrey pines. Apply VELPAR® DF only if rainfall has settled the soil around the base and root systems of the transplants.

BRUSH CONTROLLED

VELPAR® DF is recommended for the control or suppression of the following species in conifer release sites:

Ash	<i>Fraxinus spp</i>
Aspen, big tooth	<i>Populus grandidentata</i>
Aspen, trembling	<i>Populus tremuloides</i>
Birch	<i>Betula spp</i>
Elder, box	<i>Acer negundo</i>
Brambles	<i>Rubus spp</i>
Cherry, black	<i>Prunus serotina</i>
Cherry, pin	<i>Prunus pensylvanica</i>
Deerbrush	<i>Ceanothus integerrimus</i>
Dogwood, flowering*	<i>Cornus florida</i>
Elm	<i>Ulmus spp</i>
Hawthorn	<i>Crataegus spp</i>
Hazel	<i>Corylus spp</i>
Honeysuckle*	<i>Lonicera spp</i>
Manzanita, Greenleaf	<i>Arctostaphylos patula</i>
Maple, red*	<i>Acer rubrum</i>
Oaks	<i>Quercus spp</i>
Poplar, balsam	<i>Populus balsamifera</i>
Snowbrush (varnishleaf)	<i>Ceanothus velutinus</i>
Sourwood*	<i>Oxydendrum arboretum</i>
Sweetgum	<i>Liquidambar spp</i>
Willows	<i>Salix spp</i>

* Suppression – a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

In addition to brush controlled, herbaceous species listed in Weeds Controlled section of Release-Herbaceous Weed Control may be controlled with these applications.

SPRAY EQUIPMENT

When applied as a liquid spray using water as the carrier, VELPAR® DF may be applied by ground equipment or by air (helicopter only).

For ground applications, use sufficient spray volume for thorough and uniform coverage of the site to be treated, usually a minimum of 25 gallons per acre. For aerial applications, use a minimum of 5 gallons per acre.

GRID APPLICATION

Mix 2 2/3 pounds of DuPont™ VELPAR® DF with sufficient water to make one gallon of suspension and thoroughly agitate. Intermittent agitation may be required to maintain the VELPAR® DF in suspension.

Apply the VELPAR® DF suspension directly to the soil surface in a grid pattern using an exact delivery handgun applicator. This equipment delivers a thin stream of predetermined volume. VELPAR® DF should be applied during the period from hardwood bud break to early summer.

Application rate and grid pattern will depend on soil texture and woody plant composition. Use the lower rates on coarse textured soils and when the major component of the hardwoods are susceptible species. Use the high rates on fine-textured soils and where weeds identified in the label as “partial control or suppression” predominate.

Application Patterns and Rates For VELPAR® DF Suspension

	ML/Spot	Grid (Ft)	Lb/Acre
Coarse	0.5	3 X 4	1.3*
	1.2	3 X 6	2
	2.1	4 X 6	2.6
Medium/Fine	1.2	3 X 3	4
	2.3	3 X 6	4
	1.6	3 X 3	5.3
	3.1	3 X 6	5.3

* Use on deep sands with pines four years or more of age.

BASAL (SOIL) SINGLE STEM TREATMENT

Mix 2 2/3 pounds of VELPAR® DF with sufficient water to make one gallon of suspension and thoroughly agitate. Apply the VELPAR® DF suspension with an exact-delivery handgun applicator. This equipment delivers a thin stream of predetermined volume when triggered. Apply the VELPAR® DF suspension at the rate of 2 to 4 ml for each inch of stem diameter at breast height. Direct the treatment to the soil within 3 feet of the root collar of woody plants to be controlled.

For multi-stemmed and low-growing brush that have stem diameters that are difficult to determine, apply the VELPAR® DF suspension at the rate of 2 to 4 ml per 3 feet of canopy width. For tall, slender (columnar) brush types, apply 4 to 8 ml per 3 feet of height. Base the rate on whichever canopy dimension is greater (width or height). Apply the lower volumes for coarse textured soils or low organic matter soils and the higher volumes for fine textured soils or high organic matter soils.

When treating brush that requires more than a single delivery of the VELPAR® DF suspension, apply subsequent deliveries equally spaced around the target plant. If treating brush on sloping sites, apply most of the suspension on the uphill side of the stem. If treating resprouts from brush disturbed by cutting or other mechanical methods, the rate of application should be proportional to the original tree size, not just the size of sprout regrowth.

USE PRECAUTIONS

RELEASE - GRID & SINGLE STEM

- Application of VELPAR® DF spots closer than 36 inches to conifer seedlings in their first season or directly up slope from these seedlings may result in injury or mortality.
- Use VELPAR® DF on seedlings in their first or fourth year and older. Injury may result from use on two and three year old seedlings where root growth is extensive but hardiness is lacking.

RELEASE HERBACEOUS WEED CONTROL

VELPAR® DF is recommended for controlling herbaceous weeds where the following species are grown:

EASTERN US

Loblolly pine	Slash pine
Longleaf pine	Red pine

WESTERN US

Blue spruce	Noble fir
Douglas fir	Ponderosa pine
Engleman spruce	Sitka spruce
Grand fir	Western hemlock
Jeffrey pine	White fir
Lodgepole pine	

APPLICATION INFORMATION

EASTERN US

Apply VELPAR® DF as a broadcast or banded spray in the spring prior to conifer bud break to lessen conifer injury potential.

WESTERN US

Rainbelt (areas of high spring rainfall): For best results, apply as a broadcast or banded spray in the late winter or spring when weeds are actively growing, but prior to conifer budbreak. If application is made after conifer bud break, use directional spray equipment to prevent contact with conifer foliage, as injury may result.

Snowbelt (areas of low spring rainfall): For best results, apply as a broadcast or banded spray in the fall before soil freezes and after the final resting bud has hardened on the conifers. Or, spring applications may be made after snow cover melts in anticipation of rainfall prior to conifer budbreak. Weed control results from spring treatments will be dependent on sufficient rainfall following application to activate VELPAR® DF.

USE RATES

The rates listed below are for broadcast application. For band application, use proportionately less. For example, use 1/2 of the broadcast rates when treating a 3-foot band where row spacing is 6 feet. Use the higher rate range for the harder to control (*Suppression) weeds listed in the table below.

EASTERN US

DuPont™ VELPAR® DF (Lb/Acre)

Soil Description	First Year		Established Trees
	Plantings		
Loamy sand, sandy loam(50-85% sand)	1 1/3	1 1/3 - 1 2/3	
Loam, silt loam, silt, sandy clay loam	1 1/3 - 1 1/2	1 2/3 - 2 1/3	
Silty clay loam, clay loam, sandy clay, silty clay, clay	1 1/2 - 1 8/10	2 1/3 - 2 2/3	

Red pine only - Refer to recommended rates in the APPLICATION INFORMATION - Eastern US table on page 13.

WESTERN US

Refer to recommended rates in the APPLICATION INFORMATION - Western US table on page 13.

WEEDS CONTROLLED

VELPAR® DF is recommended for the control or suppression of the following species in release sites:

Asters	<i>Aster spp</i>
Aster, heath*	<i>Aster ericoides</i>
Barnyardgrass	<i>Echinochloa crus-galli</i>
Bentgrass	<i>Agrostis spp</i>
Bluegrass, annual	<i>Poa annua</i>
Brackenfern	<i>Pteridium aquilinum</i>
Bromegrass	<i>Bromus spp</i>
Carrot, wild	<i>Daucus carota</i>
Crabgrass*	<i>Digitaria spp</i>
Daisy, oxeye	<i>Chrysanthemum leucanthemum</i>
Dandelion, common*	<i>Taraxacum officinale</i>
Dandelion, false* (spotted catsear)	<i>Hypochaeris radicata</i>
Dock, curly*	<i>Rumex crispus</i>
Fescue*	<i>Festuca spp</i>
Fireweed*(willowweed)	<i>Epilobium angustifolium</i>
Fleabane	<i>Conyza spp</i>
Foxtail	<i>Setaria spp</i>
Goldenrod*	<i>Solidago spp</i>
Groundsel, common	<i>Senecio vulgaris</i>
Horseweed/marestail	<i>Conyza canadensis</i>
Orchardgrass *	<i>Dactylis glomerata</i>
Panicums	<i>Panicum spp</i>
Pinegrass	<i>Calamagrostis rubescens</i>
Ragweed, common	<i>Ambrosia elatior</i>
Ryegrass, Italian (annual)	<i>Lolium multiflorum</i>
Ryegrass, perennial*	<i>Lolium perenne</i>
Smartweed, Pennsylvania	<i>Polygonum pennsylvanicum</i>
Squawcarpet	<i>Ceanothus prostratus</i>
Velvetgrass, common	<i>Holcus lanatus</i>

* Suppression – a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

FORESTRY

IMPREGNATION ON DRY BULK FERTILIZER

VELPAR® DF is recommended for impregnating or coating dry bulk fertilizer to be applied on forested sites for the establishment or release of conifer plantations (except longleaf pine) as specified on this label.

PLANTS CONTROLLED

Fertilizer impregnated with VELPAR® DF is recommended for the control and suppression of the weeds and brush identified for the specific applications on this label. Consult the appropriate segment of this label to determine the appropriate rate of VELPAR® DF to be applied per acre. Apply this amount of VELPAR® DF to the volume of fertilizer to be applied per acre.

IMPREGNATION EQUIPMENT

To impregnate or coat the fertilizer use a system consisting of conveyor or closed drum used to blend dry bulk fertilizer.

IMPREGNATION INSTRUCTIONS

To impregnate dry bulk fertilizer with VELPAR® DF, mix the amount as prescribed above in a sufficient quantity of water to uniformly coat the desired amount of fertilizer. Suspensions of VELPAR® DF will require thorough agitation.

Direct the spray nozzles of the impregnation equipment to deliver a fine spray of the mixture toward the fertilizer for thorough coverage while avoiding contact with mixing equipment. The use of a spray pattern indicator may be beneficial to visually determine the uniformity of impregnation.

Uniform impregnation of dry bulk fertilizer may vary. If absorption of the spray is not adequate, the use of an absorptive powder or additive, such as “Microcel E” or “HiSil 233”, may be required to produce a dry, free flowing mixture.

Apply the fertilizer as soon as possible after impregnation for optimum performance. Impregnated fertilizer may become lumpy and difficult to apply following storage.

Diammonium phosphate, potassium chloride, 16-16-16 and 24-4-4 have been successfully impregnated.

APPLICATION EQUIPMENT

Applications of impregnated fertilizer may be made by ground equipment or by air (helicopter or fixed wing). Accurate calibration and patterning of the equipment is essential for uniform distribution of the impregnated fertilizer on the soil surface.

USE PRECAUTIONS

IMPREGNATED FERTILIZER FOR FORESTRY

- If fertilizer materials are excessively dusty, use a suitable additive to reduce dust prior to impregnation. Application of dusty fertilizer which has been impregnated may result in off-target drift and injury to desirable vegetation. Such

drift and associated injury may be aggravated by high wind conditions.

- The dry fertilizer must be properly impregnated and uniformly applied to avoid pine injury/mortality and poor weed and brush control.
- Uniform and precise application of the impregnated fertilizer is essential for satisfactory weed and brush control and to minimize pine injury. Overlaps or skips between adjoining swaths or non-uniform distribution of impregnated fertilizer within the swath will deliver poor results and may result in pine injury or mortality.
- Do not impregnate potassium nitrate, sodium nitrate or triple super phosphate fertilizers with DuPont™ VELPAR® DF as herbicidal action will be lost.

USE PRECAUTIONS FORESTRY

- Do not use VELPAR® DF in nurseries, seedbeds, or ornamental plantings.
- On tracts of land where various soil types are present and VELPAR® DF rate selection is difficult, conifer damage or less-than-expected vegetation suppression may occur due to the different rates required for various soil types.
- Poor weed and brush control may result from the following:
 - Heavy duff or slash present at time of application
 - Use on poorly drained sites
 - Applications made when the soil is saturated with water and rain is imminent within 24 hours
 - Applications to soils high in organic matter (greater than 5%)
- Following harvest, allow stumps and injured trees sufficient time to adequately resprout before applying VELPAR® DF.
- Where burning is desired, burn vegetation after any brush has completely defoliated, at least twice, allowing for sufficient root uptake of VELPAR® DF.
- Do not use VELPAR® DF on frozen soils; use in spring after snow melt.
- Do not add a surfactant in applications over the top of conifers.
- Weed control results from spring applications depend on sufficient moisture to activate VELPAR® DF.
- When applying VELPAR® DF after transplanting, wait until rainfall has settled the soil around the base and root systems of the transplants before making the treatment.
- Crop injury may occur when VELPAR® DF is used:
 - On trees that show poor vigor, insect damage, disease, winter injury, or other stress conditions
 - On any soil containing less than 1% organic matter
 - On loamy sand or sandy loam with less than 2% organic matter, except Jeffrey pine and Ponderosa pine
 - On conifer foliage after conifer bud break

–On gravelly or rocky soils, exposed subsoils, clay knobs, sand, or sandy soil with 85% or more sand.

- Do not cut treated vegetation for forage or hay nor graze domestic animals on treated areas for 60 days following application.

YELLOW POPLAR PLANTINGS

VELPAR® DF is recommended for the control of herbaceous weeds in the establishment of yellow poplar plantations. Applications may be made over the top of planted seedlings after the soil has settled around the root systems but before the seedlings have broken dormancy (bud break). A subsequent application may be made before dormancy break in the Spring of the second year. USE RATES: Use the rate range specified in the "RELEASE-HERBACEOUS WEED CONTROL" section for pine plantations - eastern US.

For ground application, use sufficient spray volume for uniform and thorough coverage of the site to be sprayed, usually a minimum of 25 gallons per acre. For aerial applications, use a minimum of 5 gallons of water per acre. For broader spectrum control VELPAR® DF may be tank mixed with DuPont™ ESCORT® XP herbicide. Add ESCORT® XP at a rate of 1/2 ounce per acre with the prescribed rate of VELPAR® DF.

USE PRECAUTIONS YELLOW POPLAR PLANTINGS

- Applications of VELPAR® DF and tank mixes of VELPAR® DF and DuPont™ ESCORT® XP made to yellow poplar seedlings that are suffering from loss of vigor caused by insects, disease, drought, winter damage, animal damage, excessive soil moisture, planting shock or other stresses may injure or kill the seedlings.
- Applications of VELPAR® DF and tank mixes of VELPAR® DF and ESCORT® XP should only be made after adequate rainfall has closed the planting slit and settled the soil around the roots following transplanting.
- The use of surfactant with VELPAR® DF is not recommended for applications made over the tops of seedlings.
- Careful consideration must be given by an experienced and knowledgeable forester to ensure the specific growth requirements of yellow poplar will be provided by the selected planting site. Treatment of yellow poplar planted on a site inadequate to meet its requirements may injure or kill the seedlings.

PASTURE / RANGELAND

VELPAR® DF is recommended for control of brush and weeds in pasture.

BERMUDAGRASS / BAHIAGRASS

VELPAR® DF is recommended for control of smutgrass and other weeds in established stands of bermudagrass and bahiagrass.

APPLICATION INFORMATION

Make a single application of DuPont™ VELPAR® DF per year when weeds are actively growing.

WEEDS CONTROLLED - USE RATES

VELPAR® DF effectively controls the following weeds at the rates shown in pastures. Use a lower rate on coarse-textured soils (sand to sandy loam). Use the higher rate on fine-textured soils (clay loam to clay) and on soils high in organic matter.

9/10 - 1 1/2 Lb/Acre

Barley, little	<i>Hordeum pusillum</i>
Barnyardgrass	<i>Echinochloa crus-galli</i>
Dogfennel	<i>Eupatorium capillifolium</i>
Fescue	<i>Festuca spp</i>
Lespedeza	<i>Lespedeza cuneata</i>
Oxalis	<i>Oxalis spp</i>
Passionflower, maypop	<i>Passiflora incarnate</i>
Pepperweed, Virginia	<i>Lepidium virginicum</i>
Pigweed	<i>Amaranthus spp</i>
Smutgrass*	<i>Sporobolus indicus</i>

* Suppression may result with some of the giant (larger) smutgrass species.

Suppression – a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

SPRAY EQUIPMENT

Apply VELPAR® DF uniformly over the desired area using ground equipment only.

For ground application, use enough water for thorough coverage usually a minimum of 25 gallons per acre. The use of a surfactant may increase the potential for bermudagrass or bahiagrass injury.

USE PRECAUTIONS - PASTURE

- Use VELPAR® DF only in stands of bermudagrass and bahiagrass established for at least one year. Do not treat newly sprigged or sodded areas.
- Some temporary discoloration of the bermudagrass or bahiagrass may occur after application.
- Treatment of mixed pastures containing forage species other than bermudagrass or bahiagrass may result in injury or mortality to the other forage species.
- Injury may result when desirable grasses are under stress from drought, insects, disease, cold temperature, or poor fertility.
- Injury to or loss of desirable trees or other plants may result if VELPAR® DF is applied or if equipment is drained or flushed on or near desirable trees or other plants, on areas where their roots may extend, or in locations where the chemical may be washed or moved into contact with their roots.
- Severe crop injury may occur if applications are made on gravelly or rocky soils, thinly covered subsoils, or soils with less than 1% organic matter.
- For broadcast pasture applications of VELPAR® DF, do not cut treated vegetation for forage or hay nor graze domestic animals on treated areas for 60 days.

PASTURE / RANGELAND BRUSH CONTROL

VELPAR® DF is recommended for the control of undesirable brush in pasture or rangeland.

APPLICATION INFORMATION

Apply VELPAR® DF from late winter through summer, pre-budbreak until new growth hardens off.

In areas where the soil remains frozen during the winter and spring rains are usually inadequate for soil activation, a fall or winter treatment may be applied before the soil freezes.

For rates needed to control the species below, see the **Forestry - Release, Use Rates** section.

BRUSH CONTROLLED

VELPAR® DF is recommended for the control or suppression of the following brush species in pasture and rangeland:

Alder	<i>Alnus spp</i>
Ash	<i>Fraxinus spp</i>
Aspen	<i>Populus spp</i>
Birch	<i>Betula spp</i>
Blackgum	<i>Nyssa sylvatica</i>
Bay, sweet	<i>Magnolia virginiana</i>
Catclaw acacia	<i>Acacia greggii</i>
Cedar, Eastern red	<i>Juniperus virginiana</i>
Cherry, black	<i>Prunus serotina</i>
Chinaberry*	<i>Melia azedarach</i>
Deerbrush	<i>Ceanothus integerrimus</i>
Dogwood, flowering*	<i>Cornus florida</i>
Elm, American	<i>Ulmus Americana</i>
Elm, Chinese	<i>Ulmus parvifolia</i>
Hackberry, common	<i>Celtis occidentalis</i>
Hawthorn	<i>Crataegus spp</i>
Hazel	<i>Corylus spp</i>
Hickory	<i>Carya spp</i>
Huisache	<i>Acacia farnesiana</i>
Juniper	<i>Juniperus spp</i>
Locust	<i>Robinia spp</i>
Lotebush	<i>Ziziphus obtusifolia</i>
Manzanita, Greenleaf	<i>Arctostaphylos patula</i>
Maple, red	<i>Acer rubrum</i>
Mulquite	<i>Prosopis glandulosa</i>
Mulberry	<i>Morus spp</i>
Oaks	<i>Quercus spp</i>
Osage-orange	<i>Maclura pomifera</i>
Persimmon	<i>Diospyros spp</i>
Plum, wild	<i>Prunus munsoniana</i>
Poplar, balsam	<i>Populus balsamifera</i>
Poplar, yellow	<i>Liriodendron tulipifera</i>
Privet	<i>Ligustrum spp</i>
Rose, multiflora	<i>Rosa multiflora</i>
Sassafras*	<i>Sassafras albidum</i>
Soapweed, small (yucca)	<i>Yucca glauca</i>
Snowbrush (varnishleaf)	<i>Ceanothus velutinus</i>
Sourwood	<i>Oxydendrum arboretum</i>
Sumac	<i>Rhus spp</i>
Sweetgum	<i>Liquidambar spp</i>
Tallow, Chinese	<i>Sapium sebiferum</i>
Waxmyrtle	<i>Myrica cerifera</i>
Whitebrush	<i>Aloysia gratissima</i>
Willow	<i>Salix spp</i>

* Suppression – a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

SPRAY EQUIPMENT AND APPLICATION TECHNIQUES

Basal (Soil)-Mix 2 2/3 pounds of DuPont™ VELPAR® DF with sufficient water to make one gallon of suspension and thoroughly agitate. Apply the VELPAR® DF suspension with an exact-delivery handgun applicator. This equipment delivers a thin stream of predetermined volume when triggered. Apply the VELPAR® DF suspension at the rate of 2 to 4 ml for each inch of stem diameter at breast height. Direct the treatment to soil within 3 inches of the root collar of woody plants to be controlled. When treating large stems and when more than one delivery of the VELPAR® DF suspension is needed per stem, make applications on opposite sides of the stem. Do not apply more than 1/3 gallon of the VELPAR® DF suspension per acre per year. Intermittent agitation may be required to maintain the VELPAR® DF in suspension.

USE PRECAUTIONS PASTURE / RANGELAND

- Injury to or loss of desirable trees or other plants may result if VELPAR® DF is applied or if equipment is drained or flushed on or near desirable trees or other plants, on areas where their roots may extend, or in locations where the chemical may be washed or moved into contact with their roots.
- Poor weed and brush control may result from the following:
 - Use on poorly drained sites
 - Applications made when the soil is saturated with water and rain is imminent within 24 hours
 - Applications to soils high in organic matter (greater than 5%)
- Following mechanical cutting or clearing, allow stumps and injured trees sufficient time to adequately resprout before applying VELPAR® DF.
- Do not use VELPAR® DF on frozen soils.
- Weed and brush control results depend on sufficient moisture to activate VELPAR® DF.
- When VELPAR® DF is applied as a basal soil treatment, there is no restriction on grazing by domestic animals nor on cutting surrounding vegetation for forage or hay.
- For broadcast pasture applications of VELPAR® DF, do not cut treated vegetation for forage or hay nor graze domestic animals on treated areas for 60 days.

NON-AGRICULTURAL USES

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.

Industrial and Pasture/Rangeland weed and brush control applications as described on this label for DuPont VELPAR DF are not within the scope of the Worker Protection Standard.

The area being treated must be vacated by unprotected persons.

Do not enter or allow entry into treated areas until sprays have dried to perform hand tasks.

APPLICATION INFORMATION

VELPAR® DF is recommended for general weed and brush control as follows: uncultivated nonagricultural areas (such as, airports, highway, railroad and utility right-of way, sewage disposal areas); uncultivated agricultural areas (non-crop producing, which includes: farmyards, fuel storage areas, fence rows, barrier strips); industrial sites (outdoor, such as, lumberyards, pipeline and tank farms).

NONCROP INDUSTRIAL SITES

VELPAR® DF is recommended for control of many annual, biennial, and perennial weeds in noncrop, industrial sites.

APPLICATION INFORMATION

Apply VELPAR® DF as a preemergence or postemergence spray when weeds are actively germinating or growing.

WEEDS CONTROLLED - USE RATE

VELPAR® DF effectively controls the following weeds when applied at the use rates shown in industrial sites. When applied at lower rates, VELPAR® DF provides short-term control of the weeds listed; when applied at higher rates, weed control is increased and extended.

Use lower rate on coarse-textured soils (sand to sandy loam). Use the higher rate on fine-textured soils (clay loam to clay) and on soils high in organic matter.

2 2/3 - 6 2/3 Lb/Acre

Barnyardgrass	<i>Echinochloa crus-galli</i>
Bindweed, field*	<i>Convolvulus arvensis</i>
Bouncingbet*	<i>Saponaria officinalis</i>
Bromegrass	<i>Bromus spp</i>
Buffalograss*	<i>Buchloe dactyloides</i>
Burdock	<i>Arctium spp</i>
Cocklebur	<i>Xanthium spp</i>
Crabgrass	<i>Digitaria spp</i>
Crown vetch	<i>Coronilla varia</i>
Curly dock*	<i>Rumex crispus</i>
Dandelion, common*	<i>Taraxacum officinale</i>
Dandelion, false* (spotted catsear)	<i>Hypochaeris radicata</i>
Dogbane*	<i>Apocynum cannabinum</i>
Fiddleneck, tarweed	<i>Amsinckia lycopoides</i>
Filaree	<i>Erodium spp</i>
Fleabane, flax-leaved	<i>Conyza bonariensis</i>
Goatsbeard vine (sweet briar)	<i>Aruncus sylvestris</i>
Goldenrod	<i>Solidago spp</i>
Horseweed/marestail	<i>Conyza canadensis</i>
Lespedeza	<i>Lespedeza cuneata</i>
Milkweed, common*	<i>Asclepias syriaca</i>
Mustard, wild	<i>Sinapis arvensis</i>
Nutsedge*	<i>Cyperus spp</i>
Oats, wild*	<i>Avena fatua</i>
Orchardgrass *	<i>Dactylis glomerata</i>
Orchardgrass (seedling)	<i>Dactylis glomerata</i>
Oxalis	<i>Oxalis spp</i>
Paragrass	<i>Panicum purpurascens</i>
Parsnip, wild	<i>Pastinaca sativa</i>
Pigweed	<i>Amaranthus spp</i>
Purslane, common	<i>Portulaca oleracea</i>
Quackgrass	<i>Agropyron repens</i>
Ryegrass, Italian (annual)	<i>Lolium multiflorum</i>
Smartweed	<i>Polygonum spp</i>
Spurge	<i>Euphorbia spp</i>
Star thistle	<i>Centaurea spp</i>
Trumpet creeper*	<i>Campsis radicans</i>

8 - 10 2/3 Lb/Acre

Aster, heath	<i>Aster ericoides</i>
Bahiagrass*	<i>Paspalum notatum</i>
Bermudagrass*	<i>Cynodon dactylon</i>
Blackberry	<i>Rubus spp</i>
Bluegrass	<i>Poa spp</i>
Broomsedge	<i>Andropogon virginicus</i>
Camphorweed	<i>Heterotheca subaxillaris</i>
Canada thistle*	<i>Cirsium arvense</i>
Carrot, wild	<i>Daucus carota</i>
Chickweed	<i>Stellaria media</i>
Clovers	<i>Trifolium spp</i>
Dewberry	<i>Rubus trivialis</i>
Dogfennel	<i>Eupatorium capillifolium</i>
Fescue*	<i>Festuca spp</i>
Fingergrass	<i>Digitaria ciliaris</i>
Foxtail	<i>Setaria spp</i>
Guineagrass	<i>Panicum maximum</i>
Honeysuckle	<i>Lonicera spp</i>
Horseweed/marestail	<i>Conyza canadensis</i>
Lantana	<i>Lantana camara</i>
Lettuce, prickly	<i>Lactuca serriola</i>
Natalgrass (red top)	<i>Rhynchelytrum repens</i>
Plantain	<i>Plantago spp</i>
Ragweed, common	<i>Ambrosia elatior</i>
Smutgrass**	<i>Sporobolus indicus</i>
Spanishneedles	<i>Bidens bipinnata</i>
Vaseygrass	<i>Paspalum urvillei</i>

* Suppression – a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

** Suppression may result with some of the giant (larger) smutgrass species.

SPECIFIC WEED PROBLEMS

Control of Canada Thistle in Crown Vetch - DuPont™

VELPAR® DF is recommended for control of Canada thistle in established stands of crown vetch on noncrop sites. Make a single application of 1 - 1 2/3 lb of VELPAR® DF from late spring through mid-summer, when thistle is actively growing prior to flowering. Do not use a surfactant. Some discoloration of the crown vetch foliage may occur after application.

SPRAY EQUIPMENT

Apply VELPAR® DF uniformly over the desired area using ground equipment or helicopter. Do not apply more than 8 lbs per acre by air.

Use enough water for thorough coverage. For ground application this is usually a minimum of 25 gallons per acre. Higher application volumes may be needed to obtain uniform application with handgun equipment. For aerial applications (helicopter only) this is usually a minimum of 5 gallons per acre. Higher volumes of water may be needed when water temperatures are cold or the higher rates of VELPAR DF are used.

INDUSTRIAL TURF (UNIMPROVED ONLY)

VELPAR® DF is recommended for selective weed control in established stands of bermudagrass and/or bahiagrass in noncrop areas.

APPLICATION TIMING

Make a single application of VELPAR® DF per year when weeds are actively growing.

WEEDS CONTROLLED - USE RATE

VELPAR® DF effectively controls the following weeds at the rates shown in industrial turf (unimproved only). Use a lower rate on coarse-textured soils (sand to sandy loam). Use the higher rate on fine-textured soils (clay loam to clay) and on soils high in organic matter.

9/10 - 1 1/2 Lb/Acre

Barley, little	<i>Hordeum pusillum</i>
Barnyardgrass	<i>Echinochloa crus-galli</i>
Dogfennel	<i>Eupatorium capillifolium</i>
Fescue	<i>Festuca spp</i>
Lespedeza	<i>Lespedeza cuneata</i>
Oxalis	<i>Oxalis spp</i>
Passionflower, maypop	<i>Passiflora incarnate</i>
Pepperweed, Virginia	<i>Lepidium virginicum</i>
Pigweed	<i>Amaranthus spp</i>
Smutgrass*	<i>Sporobolus indicus</i>

* Suppression may result with some of the giant (larger) smutgrass species.

Suppression – a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

SPRAY EQUIPMENT

Apply VELPAR® DF uniformly over the desired area using ground equipment only.

For ground application, use enough water for thorough coverage usually a minimum of 25 gallons per acre. The use of a surfactant is not recommended.

USE PRECAUTIONS INDUSTRIAL UNIMPROVED TURF

- Use DuPont™ VELPAR® DF only in stands of bermudagrass and bahiagrass established for at least one year. Do not treat newly sprigged or sodded areas.
- Some discoloration of the bermudagrass or bahiagrass may occur after application.
- Injury may result when desirable grasses are under stress from drought, insects, disease, cold temperature, or poor fertility.
- Severe turf injury may occur if applications are made on gravelly or rocky soils, thinly covered subsoils, or soils with less than 1% organic matter.

NON-CROP BRUSH CONTROL

VELPAR® DF is recommended for the control of undesirable brush in non-crop sites.

APPLICATION INFORMATION

Apply VELPAR® DF from late winter through summer, prebud break until new growth hardens off.

In areas where the soil remains frozen during the winter and spring rains are usually inadequate for soil activation, a fall or winter treatment may be applied before the soil freezes.

BROADCAST

Apply 5 1/3 to 10 2/3 lb of VELPAR® DF per acre as a coarse spray by ground equipment or 5 1/3 to 8 lb per acre by air (helicopter only). Use enough water for thorough coverage. For ground equipment, usually a minimum of 25 gallons per acre. For aerial equipment, usually a minimum of 10 gallons per acre. Higher volumes of water may be needed when water temperatures are cold or the higher rates of VELPAR® DF are used.

BASAL (SOIL) SINGLE STEM TREATMENT

Mix 2 2/3 pounds of VELPAR® DF with sufficient water to make one gallon of suspension and thoroughly agitate. Apply the VELPAR® DF suspension with an exact-delivery handgun applicator. This equipment delivers a thin stream of predetermined volume when triggered. Apply the VELPAR® DF suspension at the rate of 2 to 4 ml for each inch of stem diameter at breast height.

Direct the treatment to the soil within 3 feet of the root collar of woody plants to be controlled.

For multi-stemmed and low-growing brush that have stem diameters that are difficult to determine, apply the VELPAR® DF suspension at the rate of 2 to 4 ml per 3 feet of canopy width. For tall, slender (columnar) brush types, apply 4 to 8 ml per 3 feet of height. Base the rate on whichever canopy dimension is greater (width or height).

When treating brush that requires more than a single delivery of the VELPAR® DF suspension, apply subsequent deliveries equally spaced around the target plant. If treating brush on sloping sites, apply most of the suspension on the uphill side of the stem. If treating resprouts from brush disturbed by cutting or other mechanical methods, the rate of application

should be proportional to the original tree size, not just the size of sprout regrowth.

LACING/STREAKING - Mix VELPAR® DF with water to form a concentrated suspension. Apply 5 1/3 to 10 2/3 lbs of VELPAR® DF per acre. Adjust the application equipment to deliver a narrow or straight stream spray pattern such that the swath width on the soil surface is 6 to 12 inches wide. Direct the spray at the base of the brush. Swaths or treated bands should be 2 to 4 feet apart. Apply the lower volumes for coarse textured soils or soils with low organic matter and the higher volumes for fine textured soils or soils with high organic matter.

USE RATES

VELPAR® DF is recommended for the control or suppression of the following species in non-crop sites. Use lower rate on coarse-textured soils (sand to sandy loam). Use the higher rate on fine-textured soils (clay loam to clay) and on soils high in organic matter.

5 1/3 to 10 2/3 Lb/Acre

Alder	<i>Alnus spp</i>
Ash	<i>Fraxinus spp</i>
Aspen	<i>Populus spp</i>
Birch	<i>Betula spp</i>
Blackgum	<i>Nyssa sylvatica</i>
Bay, sweet	<i>Magnolia virginiana</i>
Catclaw acacia	<i>Acacia greggii</i>
Cedar, Eastern red	<i>Juniperus virginiana</i>
Cherry, black	<i>Prunus serotina</i>
Chinaberry*	<i>Melia azedarach</i>
Deerbrush	<i>Ceanothus integerrimus</i>
Dogwood, flowering*	<i>Cornus florida</i>
Elm, American	<i>Ulmus Americana</i>
Elm, Chinese	<i>Ulmus parvifolia</i>
Hackberry, common	<i>Celtis occidentalis</i>
Hawthorn	<i>Crataegus spp</i>
Hazel	<i>Corylus spp</i>
Hickory	<i>Carya spp</i>
Huisache	<i>Acacia farnesiana</i>
Juniper	<i>Juniperus spp</i>
Locust	<i>Robinia spp</i>
Lotebush	<i>Ziziphus obtusifolia</i>
Manzanita, Greenleaf	<i>Arctostaphylos patula</i>
Maple, red	<i>Acer rubrum</i>
Mesquite	<i>Prosopis glandulosa</i>
Mulberry	<i>Morus spp</i>
Oaks	<i>Quercus spp</i>
Osage-orange	<i>Maclura pomifera</i>
Persimmon	<i>Diospyros spp</i>
Plum, wild	<i>Prunus munsoniana</i>
Poplar, balsam	<i>Populus balsamifera</i>
Poplar, yellow	<i>Liriodendron tulipifera</i>
Privet	<i>Ligustrum spp</i>
Rose, multiflora	<i>Rosa multiflora</i>
Sassafras*	<i>Sassafras albidum</i>
Soapweed, small (yucca)	<i>Yucca glauca</i>
Snowbrush (varnishleaf)	<i>Ceanothus velutinus</i>
Sourwood	<i>Oxydendrum arboretum</i>
Sumac	<i>Rhus spp</i>
Sweetgum	<i>Liquidambar spp</i>
Tallow, Chinese	<i>Sapium sebiferum</i>
Waxmyrtle	<i>Myrica cerifera</i>
Whitebrush	<i>Aloysia gratissima</i>
Willow	<i>Salix spp</i>

*Suppression – a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

USE PRECAUTIONS NON-CROP

- Injury to or loss of desirable trees or other plants may result if DuPont™ VELPAR® DF is applied or if equipment is drained or flushed on or near desirable trees or other plants, on areas where their roots may extend, or in locations where the chemical may be washed or moved into contact with their roots.
- Application spray drift may injure desirable plants.
- Poor weed and brush control may result from the following:
 - Use on poorly drained sites
 - Applications made when the soil is saturated with water and rain is imminent within 24 hours.
 - Applications to soils high in organic matter (greater than 5%).
- Following mechanical cutting or clearing, allow stumps and injured trees sufficient time to adequately resprout before applying VELPAR® DF.
- Do not use VELPAR® DF on frozen soils.
- Do not use VELPAR® DF on lawns, driveways, tennis courts, or other residential or recreational areas.
- Weed and brush control results from spring applications depend on sufficient moisture to activate VELPAR® DF.
- Do not cut treated vegetation for forage or hay nor graze domestic animals on treated areas for 60 days following application. For rates above 8 lb per acre, do not cut treated vegetation for forage or hay nor graze domestic animals for 1 year.

ADDITIONAL USE INFORMATION

SPRAY DRIFT MANAGEMENT

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

IMPORTANCE OF DROPLET SIZE

The most effective way to reduce drift potential is to apply large droplets (greater than 150–200 microns). The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. The presence of sensitive species nearby, the environmental conditions, and pest pressure may affect how an applicator balances drift control and coverage. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly or under unfavorable environmental conditions! See the Wind, Temperature and Humidity, and Temperature Inversions sections below.

CONTROLLING DROPLET SIZE - GENERAL TECHNIQUES

- Volume - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- Pressure - Use the lower spray pressures recommended for the nozzle. Higher pressure reduces droplet size and does not improve canopy penetration. When higher flow rates are needed, use a higher-capacity nozzle instead of increasing pressure.
- Nozzle Type - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles.

CONTROLLING DROPLET SIZE - AIRCRAFT

- Number of Nozzles - Use the minimum number of nozzles with the highest flow rate that provide uniform coverage.
- Nozzle Orientation - Orienting nozzles so that the spray is emitted backwards, parallel to the airstream will produce larger droplets than other orientations.
- Nozzle Type - Solid stream nozzles (such as disc and core with swirl plate removed) oriented straight back produce larger droplets than other nozzle types.

BOOM LENGTH AND HEIGHT

- **Boom Length (aircraft)** - The boom length should not exceed 3/4 of the wing length, using shorter booms decreases drift potential. For helicopters use a boom length and position that prevents droplets from entering the rotor vortices.
- **Boom Height (aircraft)** - Application more than 10 feet above the canopy increases the potential for spray drift.
- **Boom Height (ground)** Setting the boom at the lowest labeled height (if specified) which provides uniform coverage reduces the exposure of droplets to evaporation and wind. The boom should remain level with the crop and have minimal bounce.

WIND

Drift potential increases at wind speeds of less than 3 mph (due to variable direction and inversion potential) or more than 10 mph. However, many factors, including droplet size and equipment type determine drift potential at any given wind speed. **AVOID GUSTY OR WINDLESS CONDITIONS.**

Note: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they effect spray drift.

TEMPERATURE AND HUMIDITY

When making applications in hot and dry conditions, set up equipment to produce larger droplets to reduce effects of evaporation.

SURFACE TEMPERATURE INVERSIONS

Drift potential is high during a surface temperature inversion. Surface inversions restrict vertical air mixing, which causes small suspended droplets to remain close to the ground and move laterally in a concentrated cloud. Surface inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates a surface inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

SHIELDED SPRAYERS

Shielding the boom or individual nozzles can reduce the effects of wind. However, it is the responsibility of the applicator to verify that the shields are preventing drift, and not interfering with uniform deposition of the product.

SENSITIVE AREAS

The pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g., residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g., when wind is blowing away from the sensitive areas).

SPRAY TANK CLEAN OUT

Thoroughly clean all traces of DuPont™ VELPAR® DF from application equipment immediately after use. Flush the tank, pump, hoses, and boom with several changes of water after removing nozzle tips and screens (clean these parts separately). Dispose of the equipment wash water by applying it to a use-site listed on this label.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

Pesticide Storage: Store product in original container only. Store in a cool, dry place.

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

Container Disposal: For Plastic Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke. **For Fiber Sacks:** Completely empty fiber sack by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into manufacturing or application equipment. Then dispose of sack in a sanitary landfill or by incineration if allowed by State and local authorities. **For Fiber Drums With Liners:** Completely empty liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application equipment. Then dispose of liner in a sanitary landfill or by incineration if allowed by State and local authorities. If drum is contaminated and cannot be reused, dispose of in the same manner. **For Paper and Plastic Bags:** Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

Container Refilling and Disposal (For Containers up to 250 gal): This is a refillable container. If the container is to be refilled, do not rinse with any material or introduce any pesticide other than DuPont™ VELPAR® DF. Reseal and return the container to any authorized DuPont refilling facility. If the container is not to be refilled, triple rinse (or equivalent) and offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or by open burning, if allowed by state and local authorities. If burned, keep out of smoke.

For minor spills, leaks, etc., follow all precautions indicated on this label and clean up immediately. Take special care to avoid contamination of equipment and facilities during cleanup procedures and disposal of wastes. In the event of a major spill, fire or other emergency, call 1-800-441-3637 day or night.

Container Disposal for Bulk Containers: When this container is empty, replace the cap and seal all openings that have been opened during use, and return the container to the point of purchase or to a designated location named at time of purchase of this product. The container must only be refilled with this pesticide product. **DO NOT REUSE THE CONTAINER FOR ANY OTHER PURPOSE.** Prior to refilling, inspect carefully for damage such as cracks, punctures, abrasions, worn-out threads and closure devices. Check for leaks after refilling and before transporting. Do not transport if this container is damaged or leaking. If the container is damaged, leaking or obsolete, contact DuPont at 1-800-441-3637. If not returned to the point of purchase or to a designated location, triple rinse emptied container and offer for recycling. Disposal of this container must be in compliance with state and local regulations.

For minor spills, leaks, etc., follow all precautions indicated on this label and clean up immediately. Take special care to avoid contamination of equipment and facilities during cleanup procedures and disposal of wastes. In the event of a major spill, fire or other emergency, call 1-800-441-3637 day or night.

NOTICE TO BUYER: Purchase of this material does not confer any rights under patents of countries outside of the United States.

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“Microcel E” is a trademark of Johns Manville Product Corporation

“HiSil 233” is a trademark of Pittsburg Plate Glass

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LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read this Limitation of Warranty and Liability Before Buying or Using This Product. If the Terms Are Not Acceptable, Return the Product at Once, Unopened, and the Purchase Price Will Be Refunded.

It is impossible to eliminate all risks associated with the use of this product. Such risks arise from weather conditions, soil factors, off target movement, unconventional farming techniques, presence of other materials, the manner of use or application, or other unknown factors, all of which are beyond the control of DuPont. These risks can cause: ineffectiveness of the product, crop injury, or injury to non-target crops or plants. **WHEN YOU BUY OR USE THIS PRODUCT, YOU AGREE TO ACCEPT THESE RISKS.**

DuPont warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for the purpose stated in the Directions for Use, subject to the inherent risks described above, when used in accordance with the Directions for Use under normal conditions.

TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, DUPONT MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR OF MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, IN NO EVENT SHALL DUPONT OR SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT. BUYER'S OR USER'S BARGAINED-FOR EXPECTATION IS CROP PROTECTION. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, THE EXCLUSIVE REMEDY OF THE USER OR BUYER AND THE EXCLUSIVE LIABILITY OF DUPONT OR SELLER, FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY OR CONTRACT, NEGLIGENCE, TORT OR STRICT LIABILITY), WHETHER FROM FAILURE TO PERFORM OR INJURY TO CROPS OR OTHER PLANTS, AND RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT, OR AT THE ELECTION OF DUPONT OR SELLER, THE REPLACEMENT OF THE PRODUCT.

To the extent consistent with applicable law that allows such requirement, DuPont or its Ag Retailer must have prompt notice of any claim so that an immediate inspection of buyer's or user's growing crops can be made. Buyer and all users shall promptly notify DuPont or a DuPont Ag Retailer of any claims, whether based on contract, negligence, strict liability, other tort or otherwise, or be barred from any remedy.

This Limitation of Warranty and Liability may not be amended by any oral or written agreement.

For product information call: 1-888-6-DUPONT

Internet address: <http://cropprotection.dupont.com/>

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DuPont™ Velpar®

AlfaMax™

herbicide



“..... A Growing Partnership With Nature”

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DuPont™ Velpar®

AlfaMax™

herbicide

Dispersible Granules

Active Ingredient	By Weight
Hexazinone [3-cyclohexyl-6-(dimethylamino) -1-methyl-1,3,5-triazine-2,4(1H,3H)-dione]	35.3%
Diuron 3-[3,4-dichlorophenyl]-1,1-dimethylurea	42.4%
Inert Ingredients	22.3%
TOTAL	100%

EPA Reg. No. 352-665

KEEP OUT OF REACH OF CHILDREN DANGER PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

FIRST AID

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 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 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.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-441-3637 for medical emergencies involving this product.

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS DANGER! CAUSES EYE DAMAGE.

Corrosive, causes irreversible eye damage. Harmful if swallowed. Do not get in eyes or on clothing. Avoid contact with skin. Wash thoroughly with soap and water after handling.

PERSONAL PROTECTIVE EQUIPMENT

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.

Pilots, flaggers and groundboom applicators must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks
- Protective eyewear

Mixers, loaders, other applicators, and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks
- Protective eyewear

Chemical resistant gloves made of any waterproof material such as polyethylene or polyvinylchloride.

A NIOSH approved dust/mist filtering respirator with any N, R, P, or HE filter or with approval number prefix TC-21C.

Chemical resistant apron when mixing, loading, or cleaning equipment or spills.

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. 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 CONTROL STATEMENT

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

Pilots must use an enclosed cockpit that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(6)].

Flaggers supporting aerial applications must use an enclosed cab that meets the definition in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(5)] for dermal protection.

USER SAFETY RECOMMENDATIONS

USERS SHOULD: Wash hands thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove clothing/PPE 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.

ENVIRONMENTAL HAZARDS

For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning of equipment or when disposing of equipment washwater.

The active ingredient, hexazinone, in this product is known to leach through soil into ground water under certain conditions as a result of agricultural use. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in ground-water contamination.

GENERAL INFORMATION

DuPont™ VELPAR® ALFAMAX™ herbicide is a water-dispersible granule that is mixed in water and applied as a spray for weed control in alfalfa.

VELPAR® ALFAMAX™ is an effective general herbicide providing both contact and residual control of many annual and biennial weeds.

VELPAR® ALFAMAX™ is noncorrosive to equipment.

Care should be exercised when applying VELPAR® ALFAMAX™ near desirable trees or shrubs as they can absorb VELPAR® ALFAMAX™ through roots extending into treated areas.

ENVIRONMENTAL CONDITIONS AND BIOLOGICAL ACTIVITY

VELPAR® ALFAMAX™ is absorbed through the roots and foliage. Moisture is required to activate VELPAR® ALFAMAX™ in the soil. Best results are obtained when the soil is moist at the time of application and 1/2–1 inch of rainfall occurs within 2 weeks after application.

For best results, apply VELPAR® ALFAMAX™ preemergence or postemergence when weeds are less than 2 inches in height or diameter. Herbicidal activity is most effective under conditions of high temperature (above 80 °F), high humidity, and good soil moisture. Herbicidal activity may be reduced when vegetation is dormant, semi-dormant, or under stress (e.g. temperature or moisture).

Herbicidal activity will usually appear within 2 weeks after application to susceptible plants under warm, humid conditions; while 4–6 weeks may be required when weather is cool or dry, or when susceptible plants are under stress. If rainfall after application is inadequate to activate VELPAR® ALFAMAX™ in the soil, plants may recover from contact effects and continue to grow.

The degree and duration of control will depend on the following:

- Use rate
- Weed spectrum and size at time of application
- Environmental conditions at and following treatment

Where a rate range is shown, use the higher levels of the dosage range on hard-to-control species, fine-textured soils, or soils containing greater than 5% organic matter or carbon. Refer to the **USE RATES** table for rate ranges.

APPLICATION INFORMATION

VELPAR® ALFAMAX™ may be applied by ground equipment and, where permitted, aerial equipment. Use rates, minimum spray gallonage, and other application information are described for various uses.

MIXING

Before spraying, calibrate equipment to determine the quantity of water necessary to uniformly and thoroughly cover the vegetation and soil in a measured area to be treated. Make sure the volume of water is sufficient to completely suspend the VELPAR® ALFAMAX™.

RESISTANCE

When herbicides that affect the same biological site of action are used repeatedly over several years to control the same weed species in the same field, naturally-occurring resistant biotypes may survive a correctly applied herbicide treatment, propagate, and become dominant in that field. Adequate control of these resistant weed biotypes cannot be expected. If weed control is unsatisfactory, it may be necessary to retreat the problem area using a product affecting a different site of action.

To better manage herbicide resistance through delaying the proliferation and possible dominance of herbicide resistant weed biotypes, it may be necessary to change cultural practices within and between crop seasons such as using a combination of tillage, retreatment, tank-mix partners and/or sequential herbicide applications that have a different site of action. Weed escapes that are allowed to go to seed will promote the spread of resistant biotypes.

It is advisable to keep accurate records of pesticides applied to individual fields to help obtain information on the spread and dispersal of resistant biotypes. Consult your agricultural dealer, consultant, applicator, and/or appropriate state agricultural extension service representative for specific alternative cultural practices or herbicide recommendations available in your area.

INTEGRATED PEST MANAGEMENT

This product may be used as part of an Integrated Pest Management (IPM) program that can include biological, cultural, and genetic practices aimed at preventing economic pest damage. IPM principles and practices include field scouting or other detection methods, correct target pest identification, population monitoring, and treating when target pest populations reach locally determined action thresholds. Consult your state cooperative extension service, professional consultants or other qualified authorities to determine appropriate action treatment threshold levels for treating specific pest/crop systems in your area.

DIRECTIONS FOR USE

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

VELPAR® ALFAMAX™ should be used only in accordance with recommendations on this label, or in supplemental DuPont labeling.

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.

The correct use rates by crop and geographical area, specified on the label, and proper mixing/loading site considerations and application procedures must be followed to minimize potential for hexazinone movement into ground water. Users are encouraged to consult with their state Department of Agriculture, Extension Service, or other pesticide lead agency for information regarding soil permeability, aquifer vulnerability, and best management practices for their area. Use of this product in certain portions of California, Oregon and Washington is subject to the January 22, 2004 Order for injunctive relief in Washington Toxics Coalition et al v. EPA, C01-0132 C, (W.D.W.A). For further information, please refer to <http://www.epa.gov/pesticides/>.

AGRICULTURAL USES

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 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.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 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.
- Protective eyewear.

ALFALFA

DuPont™ VELPAR® ALFAMAX™ is recommended for control of certain weeds in established alfalfa grown for hay. Make only a single application to alfalfa grown for seed or hay.

- Do not apply within 30 days of harvest (cutting for hay), or feeding of forage or grazing.
- Do not exceed 4.3 pounds (1.5 pounds active ingredient hexazinone) per acre per year.
- Do not use on alfalfa grown for seed in any state except California.

APPLICATION TIMING

NON-DORMANT AND SEMI-DORMANT VARIETIES

In the following states, make a single application during winter months when alfalfa plants are in the least active stage of growth:

Arizona	Montana	Oklahoma	Washington
California	Nebraska	Oregon	Wyoming
Colorado	Nevada	South Dakota	
Idaho	New Mexico	Texas	
Kansas	North Dakota	Utah	

NOTE: Severe alfalfa injury may result following application, if after cutting the regrowth is more than 2 inches high, or there is significant stubble left after cutting or grazing, or the air temperature is above 90 °F.

In the following states, make a single application in the spring before new growth begins:

Connecticut	Maine	New Hampshire	Vermont
Delaware	Maryland	New Jersey	Virginia
Illinois	Massachusetts	New York	West Virginia
Indiana	Michigan	Ohio	Wisconsin
Iowa	Minnesota	Pennsylvania	
Kentucky	Missouri	Rhode Island	

DORMANT VARIETIES

Make a single application after alfalfa becomes dormant and before new growth begins in the spring. Where weeds have emerged, use a surfactant.

USE RATES

Use higher rates on hard-to-control species, fine textured soils, soils containing greater than 5% organic matter, or under adverse environmental conditions such as temperature extremes or when weeds are stressed due to low rainfall.

Select the appropriate dose for soil texture and organic matter content as follows:

Soils	VELPAR® ALFAMAX™ (Pounds per Acre) Percent Organic Matter in Soil	
	1-5%	>5%
Coarse Texture		
Loamy sand, sandy loam	1.5 - 2	3 - 4.3
Medium Texture		
Loam, silt loam, silt, clay loam, sandy clay loam	2 - 4.3	3 - 4.3
Fine Texture		
Silty clay loam, sandy clay, silty clay, clay	2 - 4.3	3 - 4.3

WEEDS CONTROLLED

DuPont™ VELPAR® ALFAMAX™, when applied preemergence or early postemergence at the following rates is recommended for the control or suppression of the following species:

0.75 - 1 Pound per Acre

Tansymustard (pinnate)	<i>Descurainia pinnata</i>
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1.5 - 3 Pounds per Acre

Barnyardgrass	<i>Echinochloa crus-galli</i>
Bluegrass, annual	<i>Poa annua</i>
Catchfly, English	<i>Silene gallica</i>
Cheatgrass (downy brome)	<i>Bromus tectorum</i>
Chickweed, common	<i>Stellaria media</i>
Cocklebur*	<i>Xanthium strumarium</i>
Corn spurry	<i>Spergula arvensis</i>
Crabgrass	<i>Digitaria sp.</i>
Dogfennel (mayweed)	<i>Anthemis cotula</i>
Fiddleneck (tarweed)	<i>Amsinckia lycopsoides</i>
Filaree, redstem	<i>Erodium cicutarium</i>
Flixweed	<i>Descurainia sophia</i>
Groundsel, common	<i>Senecio vulgaris</i>
Lambsquarter, common	<i>Chenopodium album</i>
Lettuce, miners	<i>Montia perfoliata</i>
Mustard, blue	<i>Chorispora tenella</i>
Mustard, Jim Hill	<i>Sisymbrium altissimum</i>
Orchardgrass (seedling)	<i>Dactylis glomerata</i>
Pennycress, field	<i>Thlaspi arvense</i>
Pigweed	<i>Amaranthus sp.</i>
Prickly sida*	<i>Sida spinosa</i>
Purslane, common	<i>Portulaca oleracea</i>
Radish, wild	<i>Raphanus raphanistrum</i>
Ragweed, common	<i>Ambrosia elatior</i>
Rocket, London	<i>Sisymbrium irio</i>
Rocket, yellow (wintercress)	<i>Barbarea orthoceras</i>
Salsify	<i>Tragopogon sp.</i>
Sesbania, hemp*	<i>Sesbania exaltata</i>
Shepherdspurse	<i>Capsella bursa-pastoris</i>
Sicklepod*	<i>Cassia obtusifolia</i>

* Suppression

3 - 4.3 Pounds per Acre

Alfalfa (seedling)*	<i>Medicago sativa</i>
Bluegrass, perennial* (spring only)	<i>Poa compressa</i>
Buckwheat, wild	<i>Polygonum convolvulus</i>
Cockle, white*	<i>Silene alba</i>
Dandelion, common*	<i>Taraxacum officinale</i>
Dandelion, false	<i>Hypochaeris radicata</i>
Fescue, rattleail	<i>Vulpia myuros</i>
Foxtail*	<i>Setaria sp.</i>
Gromwell, corn	<i>Lithospermum arvense</i>
Groundcherry (annual)	<i>Physalis sp.</i>
Knawel, annual	<i>Scleranthus annuus</i>
Lettuce, prickly (wild)	<i>Lactuca serriola</i>
Mexican tea*	<i>Chenopodium ambrosioides</i>
Morningglory (annual)	<i>Ipomoea sp.</i>
Mustard, wild	<i>Brassica kaber</i>
Quackgrass*	<i>Elytrigia repens</i>
Ryegrass, annual	<i>Lolium multiflorum</i>
Sprangletop, red	<i>Leptochloa filiformis</i>
Velvetgrass (seedling)	<i>Holcus lanatus</i>
Vernalgrass, sweet (seedling)	<i>Anthoxanthum odoratum</i>

* Suppression is a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally is not accepted as control.

SPRAY EQUIPMENT

Apply VELPAR® ALFAMAX™ using a fixed boom power sprayer or aerial equipment.

Add VELPAR® ALFAMAX™ to a water-filled tank and mix thoroughly. Apply in at least 20 gallons of water per acre by ground or 5 to 10 gallons of water per acre by air.

TANK MIXTURES

VELPAR® ALFAMAX™ may be tank mixed with other suitable herbicides registered for use in alfalfa. Refer to the tank mixture partner label(s) for any additional use information, precautions or restrictions. Follow the label guidelines that are the most restrictive. VELPAR® ALFAMAX™ may also be tank mixed with appropriate adjuvants used with herbicides in alfalfa.

When using VELPAR® ALFAMAX™ alone or in combination, thoroughly mix the spray tank contents by agitation if allowed to settle.

NOTE: If there is no prior use experience with the tank mixture combination, a compatibility test should be performed prior to adding the products into the spray tank.

Mixing with other herbicides

Determine the tank mixture partner(s) compatibility with VELPAR® ALFAMAX™ by following the directions below.

1. Put 1 pint of water in a quart jar.
2. Mix 2 teaspoons of VELPAR® ALFAMAX™ with 2 tablespoons of water; mix thoroughly and add to the jar.
3. Close jar securely and shake well.
4. For other herbicides used in the mixture, premix 2 teaspoons of dry material or 1 teaspoon of liquid with 2 tablespoons of water and add to the jar of VELPAR® ALFAMAX™ solution .
5. Close jar securely and shake well.
6. Watch mixture for several seconds; check again in 30 minutes.
7. If mixture does not separate, foam excessively, gel or become lumpy, it may be used.

REPLANTING

- Do not replant treated areas to any crop except corn, root crops or sugarcane within two years after treatment, as crop injury may result.
- Corn may be planted 12 months after the last treatment in areas of moderate to high rainfall (greater than 20 inches), as long as the use rate does not exceed 2.1 pounds of product per acre.
- Root crops such as potatoes, sugarbeets, radish and carrots may be planted 12 months after last treatment, provided the use rate is less than or equal to 1.5 pounds of product per acre. Sites with use rates greater than 1.5 pounds of product per acre should not be replanted to any crop (except corn as noted above) within 2 years of application, or unacceptable crop injury may result.

In areas where irrigation is needed to produce the crop, the crop rotation intervals listed may need to be extended if the normal irrigation amount is reduced for any reason.

- Sugarcane may be planted any time following treatment.
- In California, do not replant seed alfalfa areas to any crop within two years after treatment, as crop injury may result.

Flood Irrigated Alfalfa

In arid climates (10 inches of rainfall or less per year) or areas where drought conditions have prevailed for one or more years, a field bioassay should be completed prior to planting any desired crop. The results of this bioassay may require the rotation intervals listed above to be extended.

A successful bioassay means growing to maturity a test strip of the crop(s) intended for production. The test crop(s) strip should cross the entire field including knolls, low areas, and areas where any berms were located.

USE PRECAUTIONS

Best results are obtained when 1/2–1 inch of rainfall or sprinkler irrigation occurs within two weeks after application, when soil is moist at time of application, and when weeds have not germinated or are less than 2 inches in height or diameter. Heavy rainfall or excessive irrigation after application may result in crop injury or poor performance of the herbicide.

- Unless otherwise specified in this label, treat only stands of alfalfa that have been established for at least one growing season.
- In the PNW region, treat only stands that have a well developed tap root structure that is at least 10 inches in length throughout the field and the crop is healthy, vigorous, and not under stress from weather conditions, low fertility, insects or disease damage.
- In areas with short growing seasons, such as, higher elevations, adequate alfalfa tap root growth (10-12 inches in length, 0.25 inch diameter below crown) may not occur when alfalfa is grown together with a cover or nurse crop. If an adequate tap root is not present, delay application of DuPont™ VELPAR® ALFAMAX™ until the alfalfa has gone through a minimum of two growing seasons.
- On soils high in organic matter (greater than 5%), the effectiveness of VELPAR® ALFAMAX™ can be significantly reduced and weed control may be unsatisfactory.
- Crop injury, including mortality, may result in fields with restricted root growth due to non-uniform soil profiles such as gravel bases and clay lenses.
- Crop injury may result if hot weather, mid-to-high 90 degree range or higher, occurs within a few days after application.
- Do not apply to snow-covered or frozen ground.
- Since the effect of VELPAR® ALFAMAX™ on alfalfa varies with soil conditions, uniformity of application, and environmental conditions, growers should limit their first use to small areas.
- If abnormally dry conditions exist following application, restrict the first irrigation to no more than 1/2 acre inch of water.
- Do not apply to alfalfa under stress from disease, insect damage, poor root penetration due to shallow hard pans, alkalai spots, nor to flooded fields as crop injury may result.

- Do not use VELPAR® ALFAMAX™ on seedling alfalfa, alfalfa-grass mixtures, or other mixed stands as injury may result to the seedling alfalfa or companion crop.
- Do not add a surfactant to VELPAR® ALFAMAX™ when treating non-dormant alfalfa.
- Do not use VELPAR® ALFAMAX™ on gravelly or rocky soils, exposed subsoils, hardpan, sand, poorly drained soil, or alkali soils.
- Response of alfalfa to VELPAR® ALFAMAX™ may vary by variety. Temporary yellowing may occur following application to the alfalfa.

SEED ALFALFA (CALIFORNIA ONLY) - ADDITIONAL USE PRECAUTIONS

- Do not use VELPAR® ALFAMAX™ on fields that have less than 1% organic matter.
- Do not apply more than 1.5 pounds of product per acre on fields with sandy loam or loamy sand soils having 1–2% organic matter.
- Do not apply more than 1.5 pounds of product per acre on seed alfalfa that has been established for only one growing season.

IMPREGNATION ON DRY BULK FERTILIZER (EXCEPT CA AND AZ)

Dry bulk fertilizer may be impregnated or coated with VELPAR® ALFAMAX™ for application to established alfalfa. All recommendations, cautions and special precautions on this label must be followed along with state regulations relating to dry bulk fertilizer blending, impregnating and labeling. If fertilizer materials are excessively dusty, use a suitable additive to reduce dust prior to impregnation, as dusty fertilizer will result in poor distribution during application. The dry fertilizer must be properly impregnated and uniformly applied to the alfalfa to avoid crop injury and/or poor weed control.

To impregnate the fertilizer, use a system consisting of a conveyor or closed drum used to blend dry bulk fertilizer. Any commonly used fertilizer can be impregnated with VELPAR® ALFAMAX™, except VELPAR® ALFAMAX™ on limestone.

Use a minimum of 250 lb dry bulk fertilizer per acre and up to a maximum of 450 lb per acre. To impregnate or coat the dry bulk fertilizer with VELPAR® ALFAMAX™ mix with sufficient water to suspend the material and thoroughly agitate. Direct the nozzles to deliver a fine spray of this suspension toward the fertilizer for thorough coverage while avoiding spray contact with mixing equipment. Uniform impregnation of VELPAR® ALFAMAX™ to dry bulk fertilizer will vary, and if the absorptivity is not adequate, the use of an absorptive powder may be required to produce a dry, free-flowing mixture. “Microcel E” is the recommended absorbent powder. When another herbicide is used with VELPAR® ALFAMAX™, mix and impregnate the fertilizer immediately. Apply impregnated fertilizer as soon as possible after impregnation for optimum performance.

APPLICATION INFORMATION

Uniform application of VELPAR® ALFAMAX™ impregnated dry fertilizer is essential for satisfactory weed control. Accurate calibration of the application equipment is essential for uniform distribution to the surface. The recommended method of application is to apply 1/2 the

recommended rate and overlap 50%. This results in the best distribution pattern.

Determine the amount of DuPont™ VELPAR® ALFAMAX™ that should be impregnated on the dry bulk fertilizer based on the amount of fertilizer to be distributed on one acre.

Rate Chart for Impregnating Fertilizer with VELPAR® ALFAMAX™

Fertilizer Rate/Acre	VELPAR® ALFAMAX™ Rate Per Acre			
	3/4 Lbs	1.5 Lbs	3 Lbs	4.3 Lbs
250 lbs	6.0 lbs/ton	12.0 lbs/ton	24.0 lbs/ton	34.4 lbs/ton
300 lbs	5.0 lbs/ton	10.0 lbs/ton	20.0 lbs/ton	28.7 lbs/ton
350 lbs	4.3 lbs/ton	8.6 lbs/ton	13.2 lbs/ton	24.6 lbs/ton
400 lbs	3.8 lbs/ton	7.6 lbs/ton	15.2 lbs/ton	21.5 lbs/ton
450 lbs	3.3 lbs/ton	6.6 lbs/ton	13.2 lbs/ton	19.1 lbs/ton

CHEMIGATION

Apply this product only through center pivot sprinkler irrigation systems when alfalfa is in the dormant stage of growth. Do not apply this product through any other type of irrigation system. Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from non-uniform distribution of treated water.

If you have questions about calibration, you should contact State Extension Service specialists, equipment manufacturers or other experts. A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

Select the appropriate rate (see **Use Rates** section) for soil texture and organic matter content using 0.25” to 0.75” of sprinkler irrigation as a continuous injection during the application. Best results are obtained when soil is moist at time of application, and when weeds have not germinated or are less than 2” tall or across.

SPRINKLER CHEMIGATION

The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from backflow. The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump. The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.

The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops. The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.

Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

MIXING INSTRUCTIONS

1. Fill the supply tank 1/4 to 1/3 full of water.
2. While agitating, add the required amount of VELPAR® ALFAMAX™ and continue agitation until the VELPAR® ALFAMAX™ is fully dispersed, at least 5 minutes.
3. Once the VELPAR® ALFAMAX™ is fully dispersed, maintain agitation and continue filling tank with water. VELPAR® ALFAMAX™ should be thoroughly mixed with water before adding any other material.
4. As the tank is filling, add tank mix partners (if desired). Follow use precautions and directions on the tank mix partner label.
5. After thorough mixing, the agitation system can be stopped to prevent excessive foaming in the tank. Once thoroughly mixed the solution in the supply tank does not require additional agitation unless specified on the companion products label. If foaming occurs in the injection supply tank, a defoaming agent (defoamer) may be added.
6. Apply VELPAR® ALFAMAX™ spray mixture within 48 hours of mixing to avoid product degradation.

USE PRECAUTIONS - CHEMIGATION

- Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label prescribed safety devices for public water systems are in place.
- Distributing treated water in an uneven manner can result in crop injury, lack of effectiveness, or over-tolerance pesticide residues in the crop. Therefore, to ensure that the mixture is applied evenly at the recommended rate, use sufficient water, apply the mixture for the proper length of time and ensure sprinkler produces a uniform water pattern.
- Do not permit run-off during chemigation.

POSTING OF AREAS TO BE TREATED

Posting of areas to be chemigated is required when 1) any part of a treated area is within 300 feet of sensitive areas such as residential areas, labor camps, businesses, daycare centers, hospitals, in-patient clinics, nursing homes, or any public areas such as schools, parks, playgrounds, or other public facilities not including public roads, or 2) when the chemigated area is open to the public such as golf courses or retail greenhouses.

Posting must conform to all the following requirements:

- Treated areas shall be posted with signs at all usual points of entry and along likely routes of approach from the listed sensitive areas. When there are no usual points of entry, signs must be posted in the corners of the treated areas and in any other location affording maximum visibility to sensitive areas.
- The printed side of the sign should face away from the treated area towards the sensitive area. The signs shall be printed in English. Signs must be posted prior to application and must remain posted until foliage has dried and soil surface water has disappeared. Signs may remain in place indefinitely as long as they are composed of materials to prevent deterioration and maintain legibility for the duration of the posting period.

- All words shall consist of letters at least 2 1/2 inches tall, and all letters and the symbol shall be a color which sharply contrasts with their immediate background. At the top of the sign shall be the words “KEEP OUT”, followed by an octagonal stop sign symbol at least 8 inches in diameter containing the word “STOP”. Below the symbol shall be the words “PESTICIDE IN IRRIGATION WATER”.
- Posting required for chemigation does not replace other posting and reentry requirements for farm worker safety.
- **Boom Height (aircraft)** - Application more than 10 feet above the canopy increases the potential for spray drift.
- **Boom Height (ground)** Setting the boom at the lowest labeled height (if specified) which provides uniform coverage reduces the exposure of droplets to evaporation and wind. The boom should remain level with the crop and have minimal bounce.

ADDITIONAL USE INFORMATION SPRAY DRIFT MANAGEMENT

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

IMPORTANCE OF DROPLET SIZE

The most effective way to reduce drift potential is to apply large droplets (greater than 150–200 microns). The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. The presence of sensitive species nearby, the environmental conditions, and pest pressure may affect how an applicator balances drift control and coverage. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly or under unfavorable environmental conditions! See the Wind; Temperature and Humidity; and Temperature Inversions sections below.

CONTROLLING DROPLET SIZE - GENERAL TECHNIQUES

- **Volume** - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- **Pressure** - Use the lower spray pressures recommended for the nozzle. Higher pressure reduces droplet size and does not improve canopy penetration. When higher flow rates are needed, use a higher-capacity nozzle instead of increasing pressure.
- **Nozzle Type** - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles.

CONTROLLING DROPLET SIZE - AIRCRAFT

- **Number of Nozzles** - Use the minimum number of nozzles with the highest flow rate that provide uniform coverage.
- **Nozzle Orientation** - Orienting nozzles so that the spray is emitted backwards, parallel to the airstream will produce larger droplets than other orientations.
- **Nozzle Type** - Solid stream nozzles (such as disc and core with swirl plate removed) oriented straight back produce larger droplets than other nozzle types.

BOOM LENGTH AND HEIGHT

- **Boom Length (aircraft)** - The boom length should not exceed 3/4 of the wing length, using shorter booms decreases drift potential. For helicopters use a boom length and position that prevents droplets from entering the rotor vortices.

WIND

Drift potential increases at wind speeds of less than 3 mph (due to variable direction and inversion potential) or more than 10 mph. However, many factors, including droplet size and equipment type determine drift potential at any given wind speed. AVOID GUSTY OR WINDLESS CONDITIONS.

Note: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

TEMPERATURE AND HUMIDITY

When making applications in hot and dry conditions, set up equipment to produce larger droplets to reduce effects of evaporation.

SURFACE TEMPERATURE INVERSIONS

Drift potential is high during a surface temperature inversion. Surface inversions restrict vertical air mixing, which causes small suspended droplets to remain close to the ground and move laterally in a concentrated cloud. Surface inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates a surface inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

SHIELDED SPRAYERS

Shielding the boom or individual nozzles can reduce the effects of wind. However, it is the responsibility of the applicator to verify that the shields are preventing drift, and not interfering with uniform deposition of the product.

SENSITIVE AREAS

The pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g., residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g., when wind is blowing away from the sensitive areas).

SPRAY TANK CLEAN OUT

Thoroughly clean all traces of DuPont™ VELPAR® ALFAMAX™ from application equipment immediately after use. Flush the tank, pump, hoses, and boom with several changes of water after removing nozzle tips and screens (clean these parts separately). Dispose of the equipment wash water by applying it to a use site listed on this label.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

PESTICIDE STORAGE: Store product in original container only. Store in a cool, dry place.

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

Container Disposal: For Plastic Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke. **For Fiber Sacks:** Completely empty fiber sack by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into manufacturing or application equipment. Then dispose of sack in a sanitary landfill or by incineration if allowed by State and local authorities. **For Fiber Drums With Liners:** Completely empty liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application equipment. Then dispose of liner in a sanitary landfill or by incineration if allowed by State and local authorities. If drum is contaminated and cannot be reused, dispose of in the same manner. **For Paper and Plastic Bags:** Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

Container Refilling and Disposal (For Containers up to 250 gal): This is a refillable container. If the container is to be refilled, do not rinse with any material or introduce any pesticide other than DuPont™ @ ALFAMAX™. Reseal and return the container to any authorized DuPont refilling facility. If the container is not to be refilled, triple rinse (or equivalent) and offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or by open burning, if allowed by state and local authorities. If burned, keep out of smoke. For minor spills, leaks, etc., follow all precautions indicated on this label and clean up immediately. Take special care to avoid contamination of equipment and facilities during cleanup procedures and disposal of wastes. In the event of a major spill, fire or other emergency, call 1-800-441-3637 day or night.

Container Disposal for Bulk Containers: When this container is empty, replace the cap and seal all openings that have been opened during use, and return the container to the point of purchase or to a designated location named at time of purchase of this product. The container must only be refilled with this pesticide product. **DO NOT REUSE THE CONTAINER FOR ANY OTHER PURPOSE.** Prior to refilling, inspect carefully for damage such as cracks, punctures, abrasions, worn-out threads and closure devices. Check for leaks after refilling and before transporting. Do not transport if this container is damaged or leaking. If the container is damaged, leaking or obsolete, contact DuPont at 1-800-441-3637. If not returned to the point of purchase or to a designated location, triple rinse emptied container and offer for recycling. Disposal of this container must be in compliance with state and local regulations. For minor spills, leaks, etc., follow all precautions indicated on this label and clean up immediately. Take special care to avoid contamination of equipment and facilities during cleanup procedures and disposal of wastes. In the event of a major spill, fire or other emergency, call 1-800-441-3637 day or night.

NOTICE TO BUYER: Purchase of this material does not confer any rights under patents of countries outside of the United States.

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"Microcel E" is a trademark of Johns-Manville Product Corporation

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LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read this Limitation of Warranty and Liability Before Buying or Using This Product. If the Terms Are Not Acceptable, Return the Product at Once, Unopened, and the Purchase Price Will Be Refunded.

It is impossible to eliminate all risks associated with the use of this product. Such risks arise from weather conditions, soil factors, off target movement, unconventional farming techniques, presence of other materials, the manner of use or application, or other unknown factors, all of which are beyond the control of DuPont. These risks can cause: ineffectiveness of the product, crop injury, or injury to non-target crops or plants. **WHEN YOU BUY OR USE THIS PRODUCT, YOU AGREE TO ACCEPT THESE RISKS.**

DuPont warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for the purpose stated in the Directions for Use, subject to the inherent risks described above, when used in accordance with the Directions for Use under normal conditions.

TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, DUPONT MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR OF MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, IN NO EVENT SHALL DUPONT OR SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT. BUYER'S OR USER'S BARGAINED-FOR EXPECTATION IS CROP PROTECTION. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, THE EXCLUSIVE REMEDY OF THE USER OR BUYER AND THE EXCLUSIVE LIABILITY OF DUPONT OR SELLER, FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY OR CONTRACT, NEGLIGENCE, TORT OR STRICT LIABILITY), WHETHER FROM FAILURE TO PERFORM OR INJURY TO CROPS OR OTHER PLANTS, AND RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT, OR AT THE ELECTION OF DUPONT OR SELLER, THE REPLACEMENT OF THE PRODUCT.

To the extent consistent with applicable law that allows such requirement, DuPont or its Ag Retailer must have prompt notice of any claim so that an immediate inspection of buyer's or user's growing crops can be made. Buyer and all users shall promptly notify DuPont or a DuPont Ag Retailer of any claims, whether based on contract, negligence, strict liability, other tort or otherwise, or be barred from any remedy.

This Limitation of Warranty and Liability may not be amended by any oral or written agreement.

For product information call: 1-888-6-DUPONT

Internet address: <http://cropprotection.dupont.com/>

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DuPont™ Velpar®
AlfaMax™ Gold
herbicide

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DuPont™ Velpar® AlfaMax™ Gold

herbicide

Dispersible Granules

Active Ingredient	By Weight
Hexazinone [3-cyclohexyl-6-(dimethylamino) -1-methyl-1,3,5-triazine-2,4(1H,3H)-dione]	23.1%
Diuron 3-[3,4-dichlorophenyl]-1,1-dimethylurea	55.4%
Other Ingredients	21.5%
TOTAL	100%

EPA Reg. No. 352-666 EPA Est. No. _____

Nonrefillable Container

Net: _____

OR

Refillable Container

Net: _____

KEEP OUT OF REACH OF CHILDREN DANGER PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

FIRST AID

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 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 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.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-441-3637 for medical emergencies involving this product.

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS DANGER! CAUSES EYE DAMAGE.

Corrosive, causes irreversible eye damage. Harmful if swallowed. Do not get in eyes or on clothing. Avoid contact with skin. Wash thoroughly with soap and water after handling.

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.

Pilots, flaggers and groundboom applicators must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks
- Protective eyewear

Mixers, loaders, other applicators, and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks
- Protective eyewear
- Chemical resistant gloves made of any waterproof material such as polyethylene or polyvinylchloride.

A NIOSH approved half mask respirator equipped with N, R, P, or HE particulate air filters and has the approval prefix 84A-xxxx.

Chemical resistant apron when mixing, loading, or cleaning equipment or spills.

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. 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.

ENGINEERING CONTROL STATEMENT

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

Pilots must use an enclosed cockpit that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(6)].

Flaggers supporting aerial applications must use an enclosed cab that meets the definition in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(5)] for dermal protection.

USER SAFETY RECOMMENDATIONS

USERS SHOULD: Wash hands thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove clothing/PPE 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.

ENVIRONMENTAL HAZARDS

For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning of equipment or when disposing of equipment washwaters or rinsate.

The active ingredient, hexazinone, in this product is known to leach through soil into ground water under certain conditions as a result of agricultural use. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in ground-water contamination.

DIRECTIONS FOR USE

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

DuPont™ VELPAR® ALFAMAX™ GOLD must be used only in accordance with instructions on this label, or in supplemental DuPont labeling.

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.

The correct use rates by crop and geographical area, specified on the label, and proper mixing/loading site considerations and application procedures must be followed to minimize potential for hexazinone movement into ground water. Users are encouraged to consult with their state Department of Agriculture, Extension Service, or other pesticide lead agency for information regarding soil permeability, aquifer vulnerability, and best management practices for their area.

Use of this product in certain portions of California, Oregon and Washington is subject to the January 22, 2004 Order for injunctive relief in Washington Toxics Coalition et al v. EPA, C01-0132 C, (W.D.W.A). For further information, please refer to <http://www.epa.gov/pesticides/>.

PRODUCT INFORMATION

VELPAR® ALFAMAX™ GOLD herbicide is a water-dispersible granule that is mixed in water and applied as a spray for weed control in alfalfa.

VELPAR® ALFAMAX™ GOLD is an effective general herbicide providing both contact and residual control of many annual and biennial weeds.

VELPAR® ALFAMAX™ GOLD is noncorrosive to equipment.

Caution should be exercised when applying VELPAR® ALFAMAX™ GOLD near desirable trees or shrubs as they can absorb VELPAR® ALFAMAX™ GOLD through roots extending into treated areas.

ENVIRONMENTAL CONDITIONS AND BIOLOGICAL ACTIVITY

VELPAR® ALFAMAX™ GOLD is absorbed through the roots and foliage. Moisture is required to activate VELPAR® ALFAMAX™ GOLD in the soil. Best results are obtained when the soil is moist at the time of application and 1/2–1 inch of rainfall occurs within 2 weeks after application.

For best results, apply VELPAR® ALFAMAX™ GOLD preemergence or postemergence when weeds are less than 2 inches in height or diameter. Herbicidal activity is most effective under conditions of high temperature (above 80 °F), high humidity, and good soil moisture. Herbicidal activity may be reduced when vegetation is dormant, semi-dormant, or under stress (e.g. temperature or moisture).

Herbicidal activity will usually appear within 2 weeks after application to susceptible plants under warm, humid conditions; while 4–6 weeks may be required when weather is cool or dry, or when susceptible plants are under stress. If rainfall after application is inadequate to activate VELPAR® ALFAMAX™ GOLD in the soil, plants may recover from contact effects and continue to grow.

The degree and duration of control will depend on the following:

- Use rate
- Weed spectrum and size at time of application
- Environmental conditions at and following treatment

Where a rate range is shown, use the higher levels of the dosage range on hard-to-control species, fine-textured soils, or soils containing greater than 5% organic matter or carbon. Refer to the **USE RATES** table for rate ranges.

APPLICATION INFORMATION

VELPAR® ALFAMAX™ GOLD may be applied by ground equipment and, where permitted, aerial equipment. Use rates, minimum spray gallonage, and other application information are described for various uses.

MIXING

Before spraying, calibrate equipment to determine the quantity of water necessary to uniformly and thoroughly cover the vegetation and soil in a measured area to be treated. Make sure the volume of water is sufficient to completely suspend the VELPAR® ALFAMAX™ GOLD.

RESISTANCE

When herbicides that affect the same biological site of action are used repeatedly over several years to control the same weed species in the same field, naturally-occurring resistant biotypes may survive a correctly applied herbicide treatment, propagate, and become dominant in that field. Adequate control of these resistant weed biotypes cannot be expected. If weed control is unsatisfactory, it may be necessary to retreat the problem area using a product affecting a different site of action.

To better manage herbicide resistance through delaying the proliferation and possible dominance of herbicide resistant weed biotypes, it may be necessary to change cultural practices within and between crop seasons such as using a combination of tillage, retreatment, tank-mix partners and/or sequential herbicide applications that have a different site of action. Weed escapes that are allowed to go to seed will promote the spread of resistant biotypes.

It is advisable to keep accurate records of pesticides applied to individual fields to help obtain information on the spread and dispersal of resistant biotypes. Consult your agricultural dealer, consultant, applicator, and/or appropriate state agricultural extension service representative for specific alternative cultural practices or herbicide recommendations available in your area.

INTEGRATED PEST MANAGEMENT

This product may be used as part of an Integrated Pest Management (IPM) program that can include biological, cultural, and genetic practices aimed at preventing economic pest damage. IPM principles and practices include field scouting or other detection methods, correct target pest identification, population monitoring, and treating when target pest populations reach locally determined action thresholds. Consult your state cooperative extension service, professional consultants or other qualified authorities to determine appropriate action treatment threshold levels for treating specific pest/crop systems in your area.

AGRICULTURAL USES

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 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.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 48 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.
- Protective eyewear.

ALFALFA

DuPont™ VELPAR® ALFAMAX™ GOLD is registered for control of certain weeds in established alfalfa grown for hay.

- Do not apply within 30 days of harvest (cutting for hay), or feeding of forage or grazing.
- Do not exceed 1.5 pounds active ingredient hexazinone per acre per year.

APPLICATION TIMING

NON-DORMANT AND SEMI-DORMANT VARIETIES

In the following states, make a single application during winter months when alfalfa plants are in the least active stage of growth:

Arizona	Montana	Oklahoma	Washington
California	Nebraska	Oregon	Wyoming
Colorado	Nevada	South Dakota	
Idaho	New Mexico	Texas	
Kansas	North Dakota	Utah	

NOTE: Severe alfalfa injury may result following application, if after cutting the regrowth is more than 2 inches high, or there is significant stubble left after cutting or grazing, or the air temperature is above 90 °F.

In the following states, make a single application in the spring before new growth begins:

Connecticut	Maine	New Hampshire	Vermont
Delaware	Maryland	New Jersey	Virginia
Illinois	Massachusetts	New York	West Virginia
Indiana	Michigan	Ohio	Wisconsin
Iowa	Minnesota	Pennsylvania	
Kentucky	Missouri	Rhode Island	

DORMANT VARIETIES

Make a single application after alfalfa becomes dormant and before new growth begins in the spring. Where weeds have emerged, use a surfactant.

USE RATES

Use higher rates on hard-to-control species, fine textured soils, soils containing greater than 5% organic matter, or under adverse environmental conditions such as temperature extremes or when weeds are stressed due to low rainfall.

Select the appropriate dose for soil texture and organic matter content as follows:

DuPont™ VELPAR® ALFAMAX™ GOLD
(Pounds per Acre)
Percent Organic Matter in Soil

Soils	1-5%	>5%
Coarse Texture		
Loamy sand, sandy loam	2.2 - 3.2	4.3
Medium Texture		
Loam, silt loam, silt, clay loam, sandy clay loam	3.2 - 4.3	4.3
Fine Texture		
Silty clay loam, sandy clay, silty clay, clay	3.2 - 4.3	4.3

WEEDS CONTROLLED

VELPAR® ALFAMAX™ GOLD, when applied preemergence or early postemergence at the following rates will control or suppress the following species:

1 - 1.5 Pounds Per Acre

Barnyardgrass (watergrass)	<i>Echinochloa crus-galli</i>
Crabgrass	<i>Digitaria sp.</i>
Lambsquarters, common	<i>Chenopodium album</i>
Pigweed	<i>Amaranthus sp.</i>
Prickly sida*	<i>Sida spinosa</i>
Purslane, common	<i>Portulaca oleracea</i>
Ragweed, common	<i>Ambrosia elatior</i>
Sesbania, hemp*	<i>Sesbania exaltata</i>
Sicklepod*	<i>Cassia obtusifolia</i>
Tansymustard (pinnate)	<i>Descurainia pinnata</i>

* Suppression - a visible reduction in plant population and/or plant vigor as compared to an untreated area and generally not accepted as control.

2.2 - 3 Pounds Per Acre

Bluegrass, annual	<i>Poa annua</i>
Buckwheat, wild	<i>Polygonum convolvulus</i>
Catchfly, English	<i>Silene gallica</i>
Chickweed, common	<i>Stellaria media</i>
Dogfennel (mayweed)	<i>Anthemis cotula</i>
Fescue, rattle	<i>Vulpia myuros</i>
Fiddleneck (tarweed)	<i>Amsinckia lycopoides</i>
Filaree, redstem	<i>Erodium cicutarium</i>
Flixweed	<i>Descurainia sophia</i>
Foxtail	<i>Setaria sp.</i>
Gromwell, corn	<i>Lithospermum arvense</i>
Groundcherry (annual)	<i>Physalis sp.</i>
Groundsel, common	<i>Senecio vulgaris</i>
Knawel, annual	<i>Scleranthus annuus</i>
Lettuce, miners	<i>Montia perfoliata</i>
Lettuce, prickly (wild)	<i>Lactuca serriola</i>
Morningglory (annual)	<i>Ipomoea sp.</i>
Mustard, blue	<i>Chorispora tenella</i>
Mustard, Jim Hill	<i>Sisymbrium altissimum</i>
Mustard, wild	<i>Brassica kaber</i>
Pennycress, field	<i>Thlaspi arvense</i>
Radish, wild	<i>Raphanus raphanistrum</i>
Rocket, London	<i>Sisymbrium irio</i>
Rocket, yellow (wintercress)	<i>Barbarea orthoceras</i>
Shepherdspurse	<i>Capsella bursa-pastoris</i>
Sprangletop, red	<i>Leptochloa filiformis</i>
Spurry, corn	<i>Spergula arvensis</i>
Velvetgrass	<i>Holcus lanatus</i>
Vernalgrass, sweet (annual)	<i>Anthoxanthum odoratum</i>

3.2 - 4.3 Pounds Per Acre

Alfalfa, seedling**	<i>Medicago sativa</i>
Bluegrass, perennial* (spring only)	<i>Poa pratensis</i>
Cheatgrass (downy brome)	<i>Bromus tectorum</i>
Cockle, white**	<i>Melandrium album</i>
Dandelion, common**	<i>Taraxacum officinale</i>
Orchardgrass (seedling)	<i>Dactylis glomerata</i>
Quackgrass**	<i>Agropyron repens</i>
Salsify	<i>Tragopogon sp.</i>
Tea, Mexican**	<i>Chenopodium ambrosoides</i>

**VELPAR® ALFAMAX GOLD at the rate of 4.3 pounds per acre provides suppression of these weeds.

ALFALFA GROWN FOR SEED

CA, ID, MT, NV, OR, UT, WA

VELPAR® ALFAMAX™ GOLD is registered for the control or suppression of many annual broadleaf weeds and grasses in established alfalfa grown for seed.

ADDITIONAL USE DIRECTIONS

SEED ALFALFA

- Do not stress the alfalfa as crop injury may occur. Conditions that might cause injury could include drought stress, or induced drought stress to stimulate seed set, followed by irrigation resulting in a rapid uptake of product into the plant.
- Do not apply more than 2.2 pounds of product per acre on fields with sandy loam or loamy sand soils having 1-2% organic matter.
- Do not apply more than 2.2 pounds of product per acre on seed alfalfa that has been established for only one growing season.
- If abnormally dry conditions exist following application, restrict the first irrigation to no more than 1/2 inch of water.
- Injury or reduced seed production may occur when applications of VELPAR® ALFAMAX™ GOLD are made to alfalfa planted in fields having a shallow hardpan layer.
- Do not use VELPAR® ALFAMAX™ GOLD on gravelly or rocky soils, exposed sub-soils, hardpan, sand, poorly drained soil, or alkali soils.
- Crop injury, including mortality, or reduced flowering or seed set, may result in fields with restricted root growth due to non-uniform soil profiles such as gravel bases and clay lenses.
- Do not use VELPAR® ALFAMAX™ GOLD on fields with sandy loam or loamy sand soils having less than 1% organic matter.

SPRAY EQUIPMENT

Apply VELPAR® ALFAMAX™ GOLD using a fixed boom power sprayer or aerial equipment.

Add VELPAR® ALFAMAX™ GOLD to a water-filled tank and mix thoroughly. Apply in at least 20 gallons of water per acre by ground or 5 to 10 gallons of water per acre by air.

TANK MIXTURES

DuPont™ VELPAR® ALFAMAX™ GOLD may be tank mixed with other suitable herbicides registered for use in alfalfa. Refer to the tank mixture partner label(s) for any additional use information, precautions or restrictions. Follow the label guidelines that are the most restrictive. VELPAR® ALFAMAX™ GOLD may also be tank mixed with appropriate adjuvants used with herbicides in alfalfa.

When using VELPAR® ALFAMAX™ GOLD alone or in combination, thoroughly mix the spray tank contents by agitation if allowed to settle.

NOTE: If there is no prior use experience with the tank mixture combination, a compatibility test should be performed prior to adding the products into the spray tank.

MIXING WITH OTHER HERBICIDES

Determine the tank mixture partner(s) compatibility with VELPAR® ALFAMAX™ GOLD by following the directions below.

1. Put 1 pint of water in a quart jar.
2. Mix 2 teaspoons of VELPAR® ALFAMAX™ GOLD with 2 tablespoons of water; mix thoroughly and add to the jar.
3. Close jar securely and shake well.
4. For other herbicides used in the mixture, premix 2 teaspoons of dry material or 1 teaspoon of liquid with 2 tablespoons of water and add to the jar of VELPAR® ALFAMAX™ GOLD solution .
5. Close jar securely and shake well.
6. Watch mixture for several seconds; check again in 30 minutes.
7. If mixture does not separate, foam excessively, gel or become lumpy, it may be used.

REPLANTING

- Do not replant treated areas to any crop except corn, root crops or sugarcane within two years after treatment, as crop injury may result.
- Corn may be planted 12 months after the last treatment in areas of moderate to high rainfall (greater than 20 inches), as long as the use rate does not exceed 3.2 pounds of product per acre.
- Root crops such as potatoes, sugarbeets, radish and carrots may be planted 12 months after last treatment, provided the use rate is less than or equal to 2.2 pounds of product per

acre. Sites with use rates greater than 2.2 pounds of product per acre should not be replanted to any crop within 2 years of application, or unacceptable crop injury may result.

- In areas where irrigation is needed to produce the crop, or in irrigated alfalfa seed production fields, the crop rotation intervals listed may need to be extended if the normal irrigation amount is reduced for any reason, such as induced drought stress to stimulate seed set.
- Sugarcane may be planted any time following treatment.
- In California, do not replant seed alfalfa areas to any crop within two years after treatment, as crop injury may result.

FLOOD IRRIGATED ALFALFA

When replanting alfalfa to other crops where flood irrigation was used, follow the guidelines listed above plus the information below:

In arid climates (10 inches of rainfall or less per year) or areas where drought conditions have prevailed for one or more years, a field bioassay should be completed prior to planting any desired crop. The results of this bioassay may require the rotation intervals listed above to be extended.

A successful bioassay means growing to maturity a test strip of the crop(s) intended for production. The test crop(s) strip should cross the entire field including knolls, low areas, and areas where any berms were located.

IMPREGNATION ON DRY BULK FERTILIZER (EXCEPT CA AND AZ)

Dry bulk fertilizer may be impregnated or coated with VELPAR® ALFAMAX™ GOLD for application to established alfalfa. All directions, cautions and special precautions on this label must be followed along with state regulations relating to dry bulk fertilizer blending, impregnating and labeling. If fertilizer materials are excessively dusty, use a suitable additive to reduce dust prior to impregnation, as dusty fertilizer will result in poor distribution during application. The dry fertilizer must be properly impregnated and uniformly applied to the alfalfa to avoid crop injury and/or poor weed control.

To impregnate the fertilizer, use a system consisting of a conveyor or closed drum used to blend dry bulk fertilizer. Any commonly used fertilizer can be impregnated with VELPAR® ALFAMAX™ GOLD, except VELPAR® ALFAMAX™ GOLD on limestone.

Use a minimum of 250 pounds dry bulk fertilizer per acre and up to a maximum of 450 pounds per acre. To impregnate or

RATE CHART FOR IMPREGNATING FERTILIZER WITH VELPAR® ALFAMAX™ GOLD

Fertilizer Rate/Acre	1 lb	1.5 lbs	2.2 lbs	3 lbs	3.2 lbs	4.3 lbs
250	8.0 lbs/ton	12.0 lbs/ton	17.6 lbs/ton	24.0 lbs/ton	25.6 lbs/ton	34.4 lbs/ton
300	6.7 lbs/ton	10.0 lbs/ton	14.7 lbs/ton	20.0 lbs/ton	21.5 lbs/ton	28.7 lbs/ton
350	5.7 lbs/ton	8.6 lbs/ton	12.5 lbs/ton	13.2 lbs/ton	18.3 lbs/ton	24.6 lbs/ton
400	5.0 lbs/ton	7.6 lbs/ton	11.0 lbs/ton	15.2 lbs/ton	16.0 lbs/ton	21.5 lbs/ton
450	4.4 lbs/ton	6.6 lbs/ton	9.7 lbs/ton	13.2 lbs/ton	14.1 lbs/ton	19.1 lbs/ton

coat the dry bulk fertilizer with DuPont™ VELPAR® ALFAMAX™ GOLD mix with sufficient water to suspend the material and thoroughly agitate. Direct the nozzles to deliver a fine spray of this suspension toward the fertilizer for thorough coverage while avoiding spray contact with mixing equipment. Uniform impregnation of VELPAR® ALFAMAX™ GOLD to dry bulk fertilizer will vary, and if the absorptivity is not adequate, the use of an absorptive powder may be required to produce a dry, free-flowing mixture. “Microcel E” is the recommended absorbent powder. When another herbicide is used with VELPAR® ALFAMAX™ GOLD, mix and impregnate the fertilizer immediately. Apply impregnated fertilizer as soon as possible after impregnation for optimum performance.

APPLICATION INFORMATION

Uniform application of VELPAR® ALFAMAX™ impregnated dry fertilizer is essential for satisfactory weed control. Accurate calibration of the application equipment is essential for uniform distribution to the surface. The specified method of application is to apply one-half the specified rate and overlap 50%. This results in the best distribution pattern.

Determine the amount of VELPAR® ALFAMAX™ GOLD that should be impregnated on the dry bulk fertilizer based on the amount of fertilizer to be distributed on one acre.

CHEMIGATION

Apply this product only through center pivot sprinkler irrigation systems when alfalfa is in the dormant stage of growth. Do not apply this product through any other type of irrigation system. Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from non-uniform distribution of treated water. If you have questions about calibration, you should contact State Extension Service specialists, equipment manufacturers or other experts. A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

Select the appropriate rate (see **Use Rates** section) for soil texture and organic matter content using 0.25” to 0.75” of sprinkler irrigation as a continuous injection during the application. Best results are obtained when soil is moist at time of application, and when weeds have not germinated or are less than 2” tall or across.

SPRINKLER CHEMIGATION

The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from backflow.

The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump. The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.

The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops. The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected. Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

MIXING INSTRUCTIONS

1. Fill the supply tank 1/4 to 1/3 full of water.
2. While agitating, add the required amount of VELPAR® ALFAMAX™ GOLD and continue agitation until the VELPAR® ALFAMAX™ GOLD is fully dispersed, at least 5 minutes.
3. Once the VELPAR® ALFAMAX™ GOLD is fully dispersed, maintain agitation and continue filling tank with water. VELPAR® ALFAMAX™ GOLD should be thoroughly mixed with water before adding any other material.
4. As the tank is filling, add tank mix partners (if desired). Follow use precautions and directions on the tank mix partner label.
5. After thorough mixing, the agitation system can be stopped to prevent excessive foaming in the tank. Once thoroughly mixed the solution in the supply tank does not require additional agitation unless specified on the companion products label. If foaming occurs in the injection supply tank, a defoaming agent (defoamer) may be added.
6. Apply VELPAR® ALFAMAX™ GOLD spray mixture within 48 hours of mixing to avoid product degradation.

USE PRECAUTIONS - CHEMIGATION

- Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label prescribed safety devices for public water systems are in place.
- Distributing treated water in an uneven manner can result in crop injury, lack of effectiveness, or over-tolerance pesticide residues in the crop. Therefore, to ensure that the mixture is applied evenly at the specified rate, use sufficient water, apply the mixture for the proper length of time and ensure sprinkler produces a uniform water pattern.
- Do not permit run-off during chemigation.

POSTING OF AREAS TO BE TREATED

Posting of areas to be chemigated is required when 1) any part of a treated area is within 300 feet of sensitive areas such as residential areas, labor camps, businesses, daycare centers, hospitals, in-patient clinics, nursing homes, or any public areas such as schools, parks, playgrounds, or other public facilities not including public roads, or 2) when the chemigated area is open to the public such as golf courses or retail greenhouses.

Posting must conform to all the following requirements:

- Treated areas shall be posted with signs at all usual points of entry and along likely routes of approach from the listed sensitive areas. When there are no usual points of entry, signs must be posted in the corners of the treated areas and in any other location affording maximum visibility to sensitive areas.
- The printed side of the sign should face away from the treated area towards the sensitive area. The signs shall be printed in English. Signs must be posted prior to application and must remain posted until foliage has dried and soil surface water has disappeared. Signs may remain in place indefinitely as long as they are composed of materials to prevent deterioration and maintain legibility for the duration of the posting period.
- All words shall consist of letters at least 2 1/2 inches tall, and all letters and the symbol shall be a color which sharply contrasts with their immediate background. At the top of the sign shall be the words "KEEP OUT", followed by an octagonal stop sign symbol at least 8 inches in diameter containing the word "STOP". Below the symbol shall be the words "PESTICIDE IN IRRIGATION WATER".
- Posting required for chemigation does not replace other posting and reentry requirements for farm worker safety.

ADDITIONAL USE DIRECTIONS

- Unless otherwise specified in this label, treat only stands of alfalfa that have been established for at least one growing season.
- Avoid overlapping of spray swaths and shut off spray booms while starting, turning, slowing or stopping or crop injury may result.
- In the PNW region, treat only stands that have a well developed tap root structure that is at least 10 inches in length throughout the field and the crop is healthy, vigorous, and not under stress from weather conditions, low fertility, insects or disease damage.
- In areas with short growing seasons, such as, higher elevations, adequate alfalfa tap root growth (10-12 inches in length, 0.25 inch diameter below crown) may not occur when alfalfa is grown together with a cover or nurse crop. If an adequate tap root is not present, delay application of DuPont™ VELPAR® ALFAMAX™ GOLD until the alfalfa has gone through a minimum of two growing seasons.
- Best results are obtained when 1/2–1 inch of rainfall or sprinkler irrigation occurs within two weeks after application, when soil is moist at time of application, and when weeds have not germinated or are less than 2 inches in height or diameter. Heavy rainfall or excessive irrigation after application may result in crop injury or poor performance of the herbicide.
- On soils high in organic matter (greater than 5%), the effectiveness of VELPAR® ALFAMAX™ GOLD can be significantly reduced and weed control may be unsatisfactory.

- Crop injury, including mortality, may result in fields with restricted root growth due to non-uniform soil profiles such as gravel bases and clay lenses.
- Crop injury may result if hot weather, mid-to-high 90 degree range or higher, occurs within a few days after application.
- Do not apply to snow-covered or frozen ground.
- Since the effect of VELPAR® ALFAMAX™ GOLD on alfalfa varies with soil conditions, uniformity of application, and environmental conditions, growers should limit their first use to small areas.
- If abnormally dry conditions exist following application, restrict the first irrigation to no more than 1/2 acre inch of water.
- Response of alfalfa to VELPAR® ALFAMAX™ GOLD may vary by variety. Temporary yellowing of alfalfa may occur following VELPAR® ALFAMAX™ GOLD applications.
- Do not apply to alfalfa under stress from disease, insect damage, poor root penetration due to shallow hard pans, alkali spots, nor to flooded fields as crop injury may result.
- Do not use VELPAR® ALFAMAX™ GOLD on seedling alfalfa, alfalfa-grass mixtures, or other mixed stands as injury may result to the seedling alfalfa or companion crop.
- Do not use VELPAR® ALFAMAX™ GOLD on gravelly or rocky soils, exposed subsoils, hardpan, sand, poorly drained soil, or alkali soils.
- Do not add a surfactant to VELPAR® ALFAMAX™ GOLD when treating non-dormant alfalfa.

ADDITIONAL USE INFORMATION

SPRAY DRIFT MANAGEMENT

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

IMPORTANCE OF DROPLET SIZE

The most effective way to reduce drift potential is to apply large droplets (greater than 150–200 microns). The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. The presence of sensitive species nearby, the environmental conditions, and pest pressure may affect how an applicator balances drift control and coverage. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly or under unfavorable environmental conditions! See the Wind; Temperature and Humidity; and Temperature Inversions sections below.

CONTROLLING DROPLET SIZE - GENERAL TECHNIQUES

- **Volume** - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- **Pressure** - Use the lower spray pressures specified for the nozzle. Higher pressure reduces droplet size and does not improve canopy penetration. When higher flow rates are needed, use a higher-capacity nozzle instead of increasing pressure.
- **Nozzle Type** - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles.

CONTROLLING DROPLET SIZE - AIRCRAFT

- **Number of Nozzles** - Use the minimum number of nozzles with the highest flow rate that provide uniform coverage.
- **Nozzle Orientation** - Orienting nozzles so that the spray is emitted backwards, parallel to the airstream will produce larger droplets than other orientations.
- **Nozzle Type** - Solid stream nozzles (such as disc and core with swirl plate removed) oriented straight back produce larger droplets than other nozzle types.

BOOM LENGTH AND HEIGHT

- **Boom Length (aircraft)** - The boom length should not exceed 3/4 of the wing length, using shorter booms decreases drift potential. For helicopters use a boom length and position that prevents droplets from entering the rotor vortices.
- **Boom Height (aircraft)** - Application more than 10 feet above the canopy increases the potential for spray drift.
- **Boom Height (ground)** Setting the boom at the lowest labeled height (if specified) which provides uniform coverage reduces the exposure of droplets to evaporation and wind. The boom should remain level with the crop and have minimal bounce.

WIND

Drift potential increases at wind speeds of less than 3 mph (due to variable direction and inversion potential) or more than 10 mph. However, many factors, including droplet size and equipment type determine drift potential at any given wind speed. AVOID GUSTY OR WINDLESS CONDITIONS.

Note: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they effect spray drift.

TEMPERATURE AND HUMIDITY

When making applications in hot and dry conditions, set up equipment to produce larger droplets to reduce effects of evaporation.

SURFACE TEMPERATURE INVERSIONS

Drift potential is high during a surface temperature inversion. Surface inversions restrict vertical air mixing, which causes small suspended droplets to remain close to the ground and move laterally in a concentrated cloud. Surface inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates a surface inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

SHIELDED SPRAYERS

Shielding the boom or individual nozzles can reduce the effects of wind. However, it is the responsibility of the applicator to verify that the shields are preventing drift, and not interfering with uniform deposition of the product.

SENSITIVE AREAS

The pesticide must only be applied when the potential for drift to adjacent sensitive areas (e.g., residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g, when wind is blowing away from the sensitive areas).

SPRAY TANK CLEAN OUT

Thoroughly clean all traces of DuPont™ VELPAR® ALFAMAX™ GOLD from application equipment immediately after use. Flush the tank, pump, hoses, and boom with several changes of water after removing nozzle tips and screens (clean these parts separately). Dispose of the equipment wash water by applying it to a use-site listed on this label.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

PESTICIDE STORAGE: Store product in original container only. Store in a cool, dry place.

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

CONTAINER HANDLING: Refer to the Net Contents section of this product's labeling for the applicable "Nonrefillable Container" or "Refillable Container" designation.

Nonrefillable Plastic and Metal Containers (Capacity Equal to or Less Than 50 Pounds):

Nonrefillable container. Do not reuse or refill this container. Triple rinse container (or equivalent) 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 and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities

Nonrefillable Plastic and Metal Containers (Capacity Greater Than 50 Pounds): Nonrefillable container. Do not reuse or refill this container. Triple rinse container (or equivalent) 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. Turn the container over onto its other 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. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Nonrefillable Plastic and Metal Containers, e.g., Intermediate Bulk Containers [IBC] (Size or Shape Too Large to be Tipped, Rolled or Turned Upside Down):

Nonrefillable container. Do not reuse or refill this container. Clean container promptly after emptying the contents from this container into application equipment or mix tank and before final disposal using the following pressure rinsing procedure. Insert a lance fitted with a suitable tank cleaning nozzle into the container and ensure that the water spray thoroughly covers the top, bottom and all sides inside the container. The nozzle manufacturer generally provides instructions for the appropriate spray pressure, spray duration and/or spray volume. If the manufacturer's instructions are not available, pressure rinse the container for at least 60 seconds using a minimum pressure of 30 PSI with a minimum rinse volume of 10% of the container volume. Drain, pour or pump rinsate into application equipment or rinsate collection system. Repeat this pressure rinsing procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Nonrefillable Paper or Plastic Bags, Fiber Sacks including Flexible Intermediate Bulk Containers (FIBC) or Fiber Drums With Liners:

Nonrefillable container. Do not reuse or refill this container. Completely empty paper or plastic bag, fiber sack or drum liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application or manufacturing equipment. Then offer for recycling if available or dispose of empty paper or plastic bag, fiber sack or fiber drum and liner in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances.

Refillable Fiber Drums With Liners: Refillable container (fiber drum only). *Refilling Fiber Drum:* Refill this fiber drum with DuPont™ VELPAR® ALFAMAX™ GOLD containing hexazinone and diuron only. Do not reuse this fiber drum for any other purpose. Cleaning before refilling is the responsibility of the refiller. Completely empty liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application or manufacturing equipment. *Disposing of Fiber Drum and/or Liner:* Do not reuse this fiber drum for any other purpose other than refilling (see preceding). Cleaning the container (liner and/or fiber drum) before final disposal is the responsibility of the person disposing of the container. Offer the liner for recycling if available or dispose of liner in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. If drum is contaminated and cannot be reused, dispose of it in the manner required for its liner. To clean the fiber drum before final disposal, completely empty the fiber drum by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application or manufacturing equipment. Then offer the fiber drum for recycling if available or dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances.

All Other Refillable Containers: Refillable container. *Refilling Container:* Refill this container with DuPont™ VELPAR® ALFAMAX™ GOLD containing hexazinone and diuron only. Do not reuse this container for any other purpose. Cleaning before refilling is the responsibility of the refiller. Prior to refilling, inspect carefully for damage such as cracks, punctures, abrasions, worn out threads and closure devices. If damage is found, do not use the container, contact DuPont at the number below for instructions. Check for leaks after refilling and before transporting. If leaks are found, do not reuse or transport container, contact DuPont at the number below for instructions. *Disposing of Container:* Do not reuse this container for any other purpose other than refilling (see preceding). Cleaning the container before final disposal is the responsibility of the person disposing of the container. To clean the container before final disposal, use the following pressure rinsing procedure. Insert a lance fitted with a suitable tank cleaning nozzle into the container and ensure that the water spray thoroughly covers the top, bottom and all sides inside the container. The nozzle manufacturer generally provides instructions for the appropriate spray pressure, spray duration and/or spray volume. If the manufacturer's instructions are not available, pressure rinse the container for at least 60 seconds using a minimum pressure of 30 PSI with a minimum rinse volume of 10% of the container volume. Drain, pour or pump rinsate into application equipment or rinsate collection system. Repeat this pressure rinsing procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Outer Foil Pouches of Water Soluble Packets (WSP): Nonrefillable container. Do not reuse or refill this container. Offer for recycling if available or, dispose of the empty outer foil pouch in the trash as long as WSP is unbroken. If the outer pouch contacts the formulated product in any way, the pouch must be triple rinsed with clean water. Add the rinsate to the spray tank and dispose of the outer pouch as described previously.

Do not transport if this container is damaged or leaking. If the container is damaged, leaking or obsolete, or in the event of a major spill, fire or other emergency, contact DuPont at 1-800-441-3637, day or night.

NOTICE TO BUYER: Purchase of this material does not confer any rights under patents of countries outside of the United States.

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May 23, 2011

Mrs. Fely Frank
Environmental Scientist
Department of Pesticide Regulation
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Sacramento, CA 95814-4015

REF: Additional Study submitted in in connection with Information and Report on Hexazinone (Reg. 352-399-AA) submitted under Pesticide Contamination Prevention Act

Dear Mrs. Frank:

Please find enclosed the study for **DUPONT™ HEXAZINONE TECHNICAL (Reg No 352-399-AA)** requested by the PREC Subcommittee during the May 9, 2011 hearing on Hexazinone, conducted pursuant to the Pesticide Prevention Contamination Act. The request appears in the hearing transcript on pages 81 and 82. DuPont is submitting this study to DPR for review by the PREC Subcommittee, in order to preserve its confidentiality. Please note that the study may not be released to third parties except as authorized under Section 6254.2 of the Government Code.

In support of this additional study submission, please find the following enclosed:

- California Data Transmittal document
 - a. One (1) copy of DuPont-28749 Revision 1: Hexazinone (DPX-A3674) Technical: In Vitro Mammalian Chromosome Aberration Test.

Thank you in advance for your time and effort in processing this submission. If you have any questions or require additional information please let me know at (302)366-5736 or via e-mail: ana-cristina.rodriquez@usa.dupont.com.

Sincerely,

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CALIFORNIA DATA TRANSMITTAL DOCUMENT

DuPont™ Hexazinone Technical

Name and Address of Submitter:

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Regulatory Action in Support of Which This Package is Submitted:

Request by DPR for additional data in connection with Information and Report on Hexazinone submitted under Pesticide Contamination Prevention Act

Product Names: DuPont™ Hexazinone Technical

EPA Registration Nos.: 352-399-AA

DPR Chemical Code: 1871

Transmittal Date: May 23, 2011

Study Submitted:				
Volume	Document No.	Guideline No.	Title	US EPA MRID
1	DuPont-28749 Rev 1	870.5375	Hexazinone (DPX-A3674) Technical: In Vitro Mammalian Chromosome Aberration Test	



Submitter:

Ana Cristina Rodriguez
State Registration and Regulatory Affairs,
Manager

Date: May 23, 2011

Company Name: E.I. duPont de Nemours and Company

Company Contact: Ana Cristina Rodriguez

**TOXICOLOGICAL AND CHEMICAL DISSIMILARITIES
BETWEEN HEXAZINONE AND THE CHLORO-S-TRIAZINE
HERBICIDES**

Test Guidelines

Not Applicable

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DuPont Project Identification

DuPont-10050

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GOOD LABORATORY PRACTICE COMPLIANCE STATEMENT

U.S. EPA Good Laboratory Practice Standards (40 CFR Part 160) do not apply to the current document.

Applicant/Sponsor

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Wilmington, Delaware 19898

U.S.A.

Author



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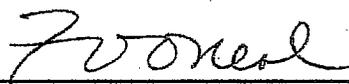
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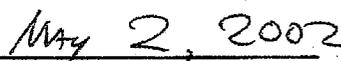
CERTIFICATION

**TOXICOLOGICAL AND CHEMICAL DISSIMILARITIES
BETWEEN HEXAZINONE AND THE CHLORO-S-TRIAZINE
HERBICIDES**

Position Paper by:



Fredrick O. O'Neal, Ph.D., D.A.B.T.
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Date

Date Completed

May 2, 2002

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TOXICOLOGICAL AND CHEMICAL DISSIMILARITIES BETWEEN HEXAZINONE AND THE CHLORO-S-TRIAZINE HERBICIDES

1.0 SUMMARY

Hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-S-triazine-2,4-(1H,3H)-dione] is a herbicide registered for a number of crop and non-crop uses. This product was first registered for use in 1975 and successfully completed re-registration in September, 1994 (EPA, 1994). This continuation reflects the favorable safety assessment by the Agency and a more than 25-year history of safe use of this product. Because hexazinone contains a six-membered heterocyclic ring, it is often presumed to be representative of a class of chloro-s-triazine herbicides, which include atrazine, cyanazine, simazine and selected metabolites. This overview describes some of the key chemical structural and toxicological differences that support the view that hexazinone is dissimilar from the chloro-s-triazine herbicides.

Although there are similarities, there are critical differences in chemical structures between hexazinone and the class of chloro-s-triazine herbicides represented by atrazine, cyanazine and simazine. The similarities include a six-membered heterocyclic ring that contains three carbon and three nitrogen atoms. The critical differences include substitutions of a cyclohexyl and a methyl group on the ring nitrogens and the presence of two ring oxo groups in hexazinone. As a result, hexazinone is less aromatic in character than the chloro-s-triazines. Collectively, these chemical differences are considered to contribute differences in toxicological properties. Hexazinone has been classified as a triazine-dione by EPA, which indicates this Agency acknowledges its differences from the chloro-s-triazine herbicide class.

Hexazinone has been extensively tested for safety to mammals and a number of ecological species (e.g., fish, birds, and beneficial organisms). Hexazinone is also rapidly metabolized and excreted. It does not bioaccumulate in mammals and aquatic organisms and does not persist in the environment. The hexazinone database is extensive and adequately characterizes the potential hazards associated with exposures to this herbicide. A key difference between hexazinone and the chloro-s-triazines is that chronic exposures to the latter produce a characteristic mammary tumor response in Sprague-Dawley rats. The mode of action for this chloro-s-triazine induced tumor response has been associated with altered endocrine activity unique to this rat strain. In contrast hexazinone does not induce rat mammary tumors, which indicates the absence of the endocrine modulation responsible for this effect. Additional evidence supporting the absence of endocrine effects with hexazinone includes the absence of endocrine organ effects and effects on reproduction and development. The differences in chemical structures are considered to be critical to the observed differences in toxicological response between hexazinone and the chloro-s-triazines. For this reason their safety assessments should be based on the extensive databases for each herbicide class.

2.0 INTRODUCTION AND OBJECTIVES

Hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-S-triazine-2,4-(1H,3H)-dione] is a herbicide registered for use on alfalfa, pasture and range grasses, pineapples, sugarcane, and blueberries. It is also registered for use on forest trees and non-crop areas. Hexazinone is applied pre- and postemergent, as a directed spray, layby, and as basal soil applications. This product was first registered for use in 1975 and successfully completed re-registration in September, 1994 (EPA, 1994).

Because hexazinone contains a six-membered heterocyclic ring, it is often presumed to be representative of a class of chloro-s-triazine herbicides, which include atrazine, cyanazine, simazine and selected metabolites. The objective of this document is to describe the significant differences in chemical structure between hexazinone and these chloro-s-triazine herbicides and to correlate these chemical differences to differences in toxicology profiles.

3.0 CHEMICAL STRUCTURE COMPARISONS

The chemical name for hexazinone is based on the six-membered heterocyclic ring that contains a 'tetrahydro-triazine' moiety with two oxo substitutions (Figure 1). The chemical bonding within this heterocyclic ring differs from that of the chloro-s-triazine herbicides. For example, hexazinone is more comparable to a substituted cyanuric acid, which has one of the carbonyl groups replaced with a dimethylamino group. Hexazinone also has a bulky cyclohexyl group replacing one of the hydrogen atoms attached to a ring nitrogen and a methyl group replacing a hydrogen on another ring nitrogen. This ring structure is not considered to be truly aromatic, which is the case for the chloro-s-triazines. For example, hexazinone has two fewer electrons that participate in the pi-bonding that is characteristic of the aromatic ring (Morrison, 1978). In addition hexazinone does not contain the chlorine atom and has substitutions on two of three ring nitrogens. The bonding electrons of these two ring nitrogens are localized into sigma bonds that form the connection to their respective substituents. In contrast, none of the three chloro-s-triazine ring nitrogens are substituted, and their associated bonding electrons are involved in bonding to their neighboring ring carbon atoms, and in fact, would be considered to be fully delocalized around the six-membered ring. These represent significant chemical structural differences between hexazinone and the chloro-s-triazine herbicide class. Because of these differences, regulatory agency experts have not considered hexazinone as part of the chemical class that contains atrazine, cyanazine and simazine. For example, EPA classified hexazinone as a triazine-dione in its Reregistration Eligibility Decision (RED) document (EPA, 1994). In its recent document that addresses grouping triazine pesticides on the basis of common mechanisms of toxicity, EPA (EPA, 2002) did not consider hexazinone as being in the s-chlorotriazine group (atrazine, simazine, propazine and their metabolites).

Because of these differences in chemical structure and electronic distribution, it is not unexpected that there are differences in the interaction of hexazinone and the chloro-s-triazines with biological macromolecules and in their toxicological properties. These key differences are discussed in Section 4.0.

4.0 TOXICOLOGICAL COMPARISONS

Hexazinone has been extensively tested for safety to mammals and a number of ecological species (e.g., fish, birds, beneficial organisms). Hexazinone is also rapidly metabolized and excreted. It does not bioaccumulate in mammals and aquatic organisms and does not persist in the environment. The existing database adequately characterizes the hazards potentially associated with excessive exposures to this herbicide. Because of this, the potential risks of hexazinone should be based on its substantial database rather than rely on inferences from other chemicals. The US EPA has reviewed this scientific data and granted continued use of hexazinone for crop and non-crop uses (EPA, 1994). This continuation reflects the favorable safety assessment by the Agency and a more than 25-year history of safe use of this product.

The US EPA and their Scientific Advisory Panel have also subjected the chloro-s-triazine herbicides to a rigorous review. One of the common toxicological responses of atrazine, cyanazine, simazine and related chloro-s-triazines is mammary tumor induction in the Sprague-Dawley rat (Bogdanffy, 2000; Wetzel, 1994). This response is specific to rats and to this, but not other strains of rats. The mode of action for tumor induction has been associated with the ability of chloro-s-triazines to alter hormonal balances in this rat strain (EPA SAP, 2000; Stevens, 1994; Wetzel, 1994).

Hexazinone has been rigorously tested in 2-year cancer bioassays with the Sprague-Dawley rat. Unlike the chloro-s-triazine herbicides, there were no mammary tumors and no tumors of any kind in this study. This finding clearly differentiates hexazinone from this herbicide class and is consistent with the observed differences in chemical structures described earlier. The absence of rat mammary tumors also indicates the endocrine modulation responsible for this effect is not operative with hexazinone. Additional evidence supporting the absence of endocrine activity with this molecule includes the fact that there were no effects on endocrine organs in the multiple subchronic and chronic toxicity tests. There were also no indications of impact on normal reproduction and development and offspring were not uniquely susceptible to hexazinone administration.

Taken collectively, hexazinone is an effective herbicide with a favorable safety record and differs from the s-chlorotriazine herbicides both with respect to chemical structure and results observed in laboratory animal studies.

5.0 CONCLUSIONS

There are similarities and differences in chemical structures between hexazinone and the class of chloro-s-triazine herbicides represented by atrazine, cyanazine and simazine. The similarities between hexazinone and the chloro-s-triazines include a six-membered heterocyclic ring that contains three carbon and three nitrogen atoms. However, beyond this there are significant differences, which include substitutions of a cyclohexyl and a methyl group on the ring nitrogens and the presence of two ring oxo groups. These render hexazinone less aromatic in character than the chloro-s-triazines and when considered collectively are considered to contribute differences in toxicological properties. Hexazinone has been classified as a triazine-dione by EPA,

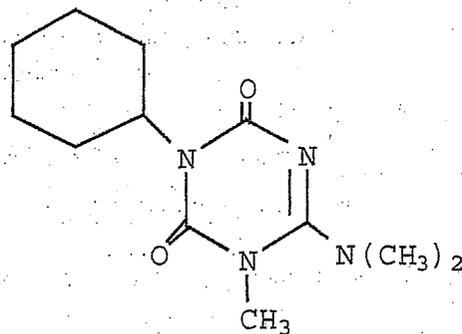
which indicates this Agency acknowledges the chemical differences between this and the chloro-s-triazines.

Hexazinone has been extensively tested for safety to mammals and a number of ecological species (e.g., fish, birds, beneficial organisms). Hexazinone is also rapidly metabolized and excreted. It does not bioaccumulate in mammals and aquatic organisms and does not persist in the environment. The existing database adequately characterizes the hazards potentially associated with excessive exposures to this herbicide. A key difference between hexazinone and the chloro-s-triazines is that chronic exposures to the latter produce a characteristic mammary tumor response in Sprague-Dawley rats. The mode of action for this chloro-s-triazine induced tumor response has been associated with altered endocrine activity unique to these rats and not considered operative in humans. In contrast to the chloro-s-triazines, hexazinone does not induce rat mammary tumors, which indicates the absence of the endocrine modulation responsible for this effect. Additional evidence supporting the absence of endocrine activity with hexazinone includes the absence of endocrine organ effects in the multiple subchronic and chronic toxicity tests and there were no effects on reproduction and development. The differences in chemical structures are considered to be critical to the observed differences in toxicological response between hexazinone and the chloro-s-triazines. For this reason their safety assessments should be based on the extensive databases for each herbicide class.

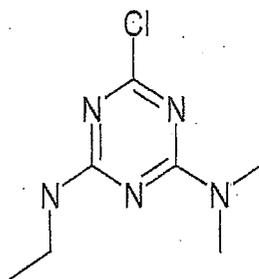
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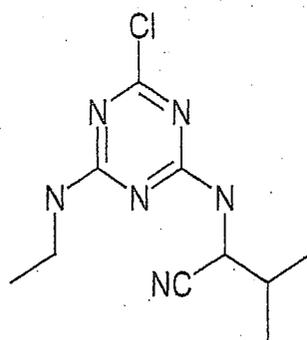
FIGURE 1 STRUCTURES OF HEXAZINONE AND SELECTED CHLORO-S-TRIAZINE HERBICIDES



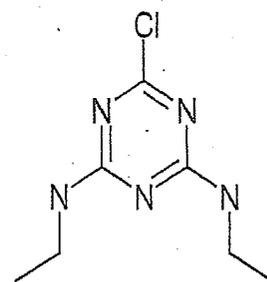
hexazinone



atrazine



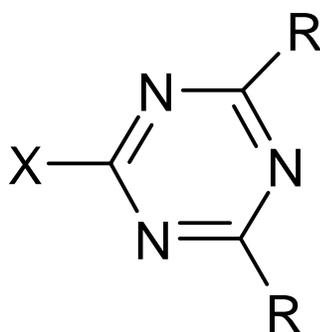
cyanazine



simazine



The Grouping of a
Series of Triazine Pesticides
Based on a Common Mechanism of Toxicity



**U.S. EPA Office of Pesticide Programs
Health Effects Division
March 2002**

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ACRONYMS

CNS	Central Nervous System
DEA	Desethyl-s-atrazine
DIA	Desisopropyl-s-atrazine
DACT	Diaminochlorotriazine
F344	Fischer 344
FQPA	Food Quality Protection Act
FSH	Follicle-stimulating Hormone
GD	Gestation Days
GnRH	Gonadotropin Releasing Hormone
HA	2-Hydroxyatrazine
HLZ	Holtzman
HPG	Hypothalamic-pituitary-gonadal
LE	Long Evans
LH	Luteinizing Hormone
LOAEL	Lowest Observed Adverse Effect Level
NE	Norepinephrine
NOAEL	No Observed Adverse Effect Level
OPP	Office of Pesticide Programs
PND	Postnatal Days
SAP	Scientific Advisory Panel
SD	Sprague Dawley
US EPA	United States Environmental Protection Agency
WOE	Weight-of-Evidence

Executive Summary

This document discusses the available scientific evidence for determining whether a common mechanism of toxicity exists among certain triazine-containing pesticides. The weight-of-evidence (WOE) analysis used is similar to the general approach outlined in the January 29, 1999 **Guidance for Identifying Pesticide Chemicals and Other Substances That Have A Common Mechanism of Toxicity** (<http://www.epa.gov/oppfead1/trac/science/#common> and <http://www.epa.gov/fedrgstr/EPA-PEST/1999/February/Day-05/6055.pdf>). The group of triazine-containing chemicals considered as candidates for grouping in this document consists of the following pesticides: **atrazine, simazine, propazine, tribenuron-methyl (Express)**, and the degradants **2-hydroxyatrazine, desethyl-s-atrazine (DEA), desisopropyl-s-atrazine (DIA)**, and **diaminochlorotriazine (DACT)**.

Treatment of laboratory animals with these chemicals results in toxic effects such as mammary gland tumors in only female rats, attenuation of the lutenizing hormone (LH) surge, alteration of the estrous cycle, altered pregnancy maintenance, and delayed pubertal development. The development of mammary gland tumors in female rats is postulated to be associated with disruption of the hypothalamic-pituitary-gonadal (HPG) axis. In summary, the proposed mode of action for induction of mammary gland tumors in female rats by atrazine involves altered secretory activity of the HPG axis, beginning with a decrease in the release of gonadotropin releasing hormone (GnRH) by the hypothalamus followed by a consequent attenuation of the afternoon LH surge during the estrous cycle. As a result, ovulation does not occur and the estrous cycle is prolonged, thereby increasing the exposure to estrogen. Increased estrogen also stimulates prolactin secretion from the pituitary. The resultant endocrine milieu of enhanced or unopposed estrogen and prolactin secretion provides an environment that is conducive to the development of mammary gland tumors. Likewise, attenuation of the surge in LH, alteration of the estrous cycle, altered pregnancy maintenance, and delayed pubertal development are considered to be either manifestations or direct consequence of disruption of the HPG axis. This proposed mode of action of atrazine for reproductive developmental effects in female SD rats (considered in this document for grouping by a common mechanism of action) was presented by the Agency to the FIFRA Scientific Advisory Panel (SAP) in June 27-29, 2000 and found to be plausible.

Based on the available WOE, only **atrazine, simazine, propazine**, and the degradants **DEA, DIA** and **DACT** can be grouped by a common mechanism of toxicity for disruption of the hypothalamic-pituitary-gonadal (HPG) axis. Although some of the evidence may support including **Express** and/or **2-hydroxyatrazine**, the overall weight-of-evidence does not support their inclusion in the common mechanism group. If additional data become available to directly support their inclusion in the common mechanism group, these data would be considered.

Thus, in the absence of additional evidence that may support an alternative grouping, **atrazine, simazine, propazine**, and the degradants **DEA, DIA** and **DACT** will be considered as a common mechanism group for purposes of a cumulative risk assessment and as part of the tolerance reassessment process for triazine pesticides.

The Grouping of a Series of Triazine Pesticides Based on a Common Mechanism of Toxicity

I. Introduction

A. Background

The Food Quality Protection Act (FQPA) amended the laws under which EPA evaluates the safety of pesticide residues in food. Among other types of information EPA is to weigh when making safety decisions, the amendments direct EPA to consider “available information concerning the cumulative effects of such residues and other substances that have a common mechanism of toxicity.” Sec. 408(b)(2)(D)(v) of the Federal Food Drug and Cosmetic Act. FQPA also directs EPA to apply the new safety standard to tolerances established prior to the passage of FQPA. Further, in carrying out the tolerance reassessment provisions of FQPA, EPA “shall give priority to review of the tolerances or exemptions that appear to pose the greatest risk to public health.” Sec. 408(q)(2).

B. Purpose

The purpose of this document is to evaluate whether there is a common mechanism for the triazine pesticides or between the triazine pesticides and other pesticides or metabolites containing a s-triazine ring. OPP used a weight-of-evidence (WOE) approach that considered all pertinent information to determine whether triazine pesticides act via a common mechanism of toxicity. A stepwise process is outlined in the 1999 Guidance for Identifying Pesticide Chemicals and Other Substances That Have A Common Mechanism of Toxicity (<http://www.epa.gov/oppfead1/trac/science/#common>). The process starts with an initial grouping of chemicals based on having shared structural, toxicological and/or pesticidal properties (US EPA, 1999a). In a second phase, the steps that define the mechanism of toxicity for one or more chemicals in the group are identified. Finally, structural, toxicological and pharmacokinetic/pharmacodynamic data for the remaining chemicals in the group are examined to determine by WOE which of these possess the same mechanism of toxicity as the other compound(s) in the group. All those chemicals found to share the same mechanism of toxicity for a common toxic effect are considered to have been grouped by a common mechanism of toxicity.

It should be noted that since the passage of the FQPA, the term “mechanism of toxicity” has taken on a specific meaning in Agency-wide guidance documents. In the draft EPA guidelines for carcinogen risk assessment, the term “mode of action” is contrasted with “mechanism” which implies a more detailed molecular description of events than is meant by mode of action (US EPA, 1999b). The definition of “mechanism of toxicity”, as implemented under FQPA, and thus used in OPP’s common mechanism guidance (US EPA, 1999a), is equivalent to the definition of the term “mode of

action.” Thus, “mechanism of toxicity” in this document is defined as *"the major steps leading to an adverse health effect following interaction of a pesticide with biological targets. All steps leading to an effect do not need to be specifically understood. Rather, it is the identification of the crucial events following chemical interaction (with biological targets) that are required in order to describe a mechanism of toxicity."*

II. The Candidate Group of Pesticides

A. The Triazines

The term "the triazines" has traditionally been used by EPA to refer to a group of 3 pesticides, atrazine, simazine, and cyanazine. See "Atrazine, Simazine and Cyanazine; Notice of Initiation of Special Review," 59 FR 60412 (November 23, 1994). OPP labeled a slightly larger group of pesticides as 1,3,5-triazines in the schedule for tolerance reassessment. In addition to atrazine, simazine, and cyanazine, pesticides so labeled included propazine, ametryn, cyromazine and prometryn. Additionally, several other pesticides or pesticide metabolites contain a s-triazine ring.

The triazines, the 1,3,5- triazines, and other pesticides or metabolites containing a s-triazine ring are derivatives of the s-triazine moiety, manufactured by the reaction of trichlorocyanuric acid (Figure 1) with appropriate intermediates. Two of the three chlorine atoms on cyanuric acid are reactive and easily replaced with other groups to yield a variety of herbicidally active compounds. The third chlorine atom may remain (e.g., in position 2) or be replaced with a methylthio or methoxy group.

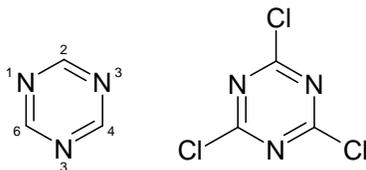


Figure 1. s-Triazine Ring (left) illustrating the ring-numbering convention and 2,4,6-trichlorocyanuric acid (right).

These compounds can be subdivided into several classes, depending on the side chain substitution: the s-triazine herbicides, the sulfonyl urea herbicides with an s-triazine moiety, and miscellaneous s-triazine herbicides. As depicted in Table 1, the s-triazine herbicides may be further subdivided by the presence of a chlorine, a methylthio, or a methoxy group in position 2 of the ring. In particular, the chloro-s-triazines comprise atrazine, simazine, propazine, terbutylazine, and cyanazine. This latter compound differs from the other 2-chloro-s-triazines by the presence of a cyano (CN) group. The methylthio s-triazines comprise ametryn, prometryn and terbutryn. The methoxy-s-triazines include prometon and terbumeton.

As depicted in Table 2, the sulfonyl urea herbicides with an s-triazine moiety comprise metsulfuron methyl, trisulfuron, chlorsulfuron, tribenuron methyl (Express), and DPX-M6316 (Harmony). These compounds differ from the s-triazine herbicides in having a bulky sulfonylurea group attached to carbon 2 of the triazine ring and in possessing an s-triazine ring with only one amino group

attached to it.

Other s-triazine pesticidal compounds considered include cyromazine, melamine, hexamethylmelamine, anilazine, and s-triazines with an aziridine or 5-nitrofuryl moiety.

B. Selection of the Candidate Group

As outlined in the 1999 Common Mechanism Guidance document (US EPA, 1999a), the stepwise process of selecting a candidate group of chemicals starts with an initial grouping of chemicals selected based on having shared structural, toxicological and/or pesticidal properties. HED first examined the triazine pesticides, atrazine, simazine, and cyanazine, for inclusion in the initial common mechanism group. That examination showed that these pesticides shared both structural characteristics and toxicological endpoints. Structurally, all three pesticides contain the s-triazine moiety. Toxicologically, the pesticides are positive for mammary gland tumors in Sprague-Dawley (SD) rats, and atrazine and simazine have data suggesting that they interfere with the LH ovulatory surge.

HED then examined whether any other 1,3,5-triazines or other pesticides or metabolites containing s-triazine rings shared these characteristics. As shown in Table 1, four of the five 2-chloro-s-triazines, atrazine, simazine, propazine, and cyanazine, as well as metabolite DACT (Table 3), are positive for mammary gland tumors in female SD rats. Terbutylazine produced mammary gland tumors in Tif:RA1f female rats in addition to benign testicular tumors in males. Although 2-hydroxyatrazine does not produce mammary gland tumors, it has been found to produce some reproductive developmental effects consistent with atrazine.

Terbutryn produced mammary gland tumors (CR:CD rats), and, in addition, produced statistically significant increases in combined benign and malignant tumors in testis, thyroid, and liver (Table 1). Prometryn and ametryn were negative for rodent mammary gland tumors.

Among the methoxy s-triazines shown in Table 1, terbumeton was positive for mammary gland tumors, but it is not marketed in the United States. Prometon was negative for oncogenicity in rodents.

As shown in Table 2, only one sulfonyl urea herbicide (Express) produced statistically significant incidences of benign and combined benign/malignant mammary gland tumors in female SD rats. The effect was seen at a considerably higher dose (1250 ppm) compared to that observed for other s-triazines and no other tumors were observed. Because metabolism data for Express indicate that cleaved s-triazine products are seen in tissues and excreta of dosed female rats, the sulfonyl urea herbicide is included in the candidate group, based on its capacity to produce mammary gland tumors in female SD rats and evidence that a triazine moiety is released during metabolism of the

parent compound. No rodent mammary gland tumors were seen for the other four listed sulfonyl urea herbicides, metsulfuronmethyl (SD rats, up to 5000 ppm), trisulfuron (SD rats, up to 6000 ppm), chlorsulfuron (up to 2500 ppm), and harmony (CD rats, up to 2500 ppm).

Based upon OPP's review of the available toxicity information, a subset of eight pesticides containing the triazine moiety – atrazine, simazine, propazine, cyanazine, terbutylazine, terbumeton, terbutryn, tribenuron methyl (Express) – were found to cause the similar toxic effect of inducing mammary gland tumors only in female rats but not male rats or both sexes of mice. The other triazine-containing pesticides – ametryn, prometryn, prometon, metsulfuron methyl, trisulfuron, chlorsulfuron, DPX-M6316 (Harmony), cyromazine, melamine, hexamethylmelamine, anilazine, and s-triazines with an aziridine or 5-nitrofuryl moiety– do not cause that carcinogenic profile or their structures contain moieties that have a confounding effect as to their mechanism of toxicity, and there is no known mechanism of toxicity that would support grouping them by a common mechanism with atrazine, simazine, and cyanazine.

Further, only four of the subset of eight triazine-containing pesticides– atrazine, propazine, simazine, and Express – have uses that result in exposure to the general public; the other four– terbutylazine, terburmeton, cyanazine, and terbutryn – do not have tolerances and either are not registered or have registrations that do not involve exposure to the general public.

Thus, as shown in Table 3, the compounds being considered in making a determination about grouping pesticides via a common mechanism of toxicity are **atrazine, simazine, propazine, tribenuron methyl (Express)** and metabolites, **2-hydroxyatrazine, DACT, DEA, and DIA**, given their structures, ability to induce mammary gland tumors in female SD rats, and/or ability to affect LH-dependent events. This group hereafter will be referred to as the **candidate group**. The metabolites are specifically included because atrazine, simazine, and propazine break down to two or all of them and they are found as residues in drinking water and food. Toxicity data on the chloro-s-triazine metabolites also provide for supporting the common mechanism of toxicity for the parent compounds.

Table 1. SAR and Mammary Gland Tumor Induction by Various s-Triazines Compounds in Rats

	Atrazine + Positive for mammary gland tumors at 70 ppm	Simazine + Positive for mammary gland tumors at 100 ppm	Propazine + Positive for mammary gland tumors at 3 ppm	Terbutylazine + Positive for mammary gland tumors at 750 ppm ¹	Cyanazine + Positive for mammary gland tumors at 5 ppm
	Ametryn (-)	NE ³	Prometryn (-) Negative for oncogenicity up to doses of 3000 ppm	Terbutryn + Positive for mammary gland tumors at 3000 ppm ²	NE ³
	NE ³	NE ³	Prometon (-) Negative for oncogenicity up to doses of 1000 ppm	Terbumeton +	NE ³
	OH-Atrazine (-)	NE ³	NE ³	NE ³	NE ³

¹ Dose considered to be excessive, EPA Classification of D (not classifiable to human carcinogenicity). Study used Tif:RAIf rats. Benign interstitial cell tumors of the testes were also observed.

² Also statistically significant ($p \leq 0.03$) increase in combined benign and malignant tumors in testis, thyroid, and liver. ³ NE = not evaluated

Table 2. Mammary Gland Tumor Induction by Sulfonylurea Herbicides Containing the s-Triazine Moiety

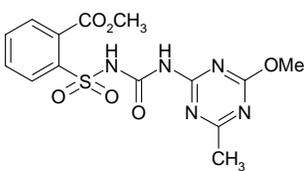
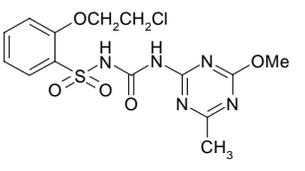
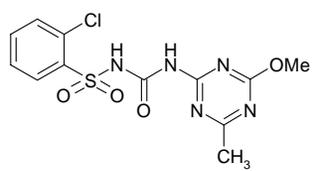
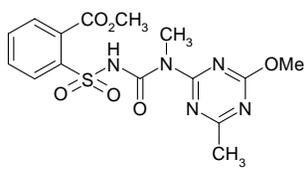
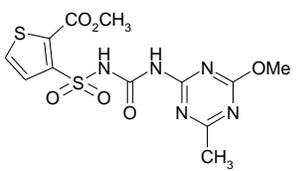
				
<p>Metsulfuronmethyl (-)</p>	<p>Trisulfuron (-)</p>	<p>Chlorsulfuron (-)</p>	<p>DPX-L5300 (Express) + Positive for oncogenicity at 1250 ppm</p>	<p>DPX-M6316 (Harmony) (-)</p>

Table 3. Structures of the Compounds in the Candidate Group

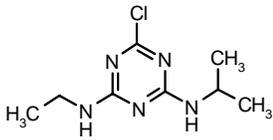
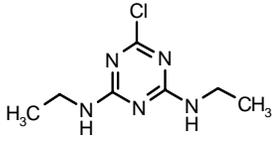
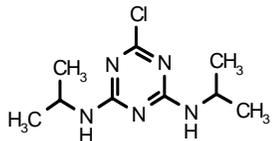
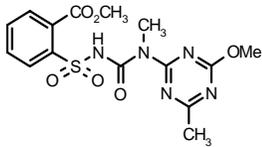
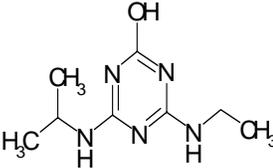
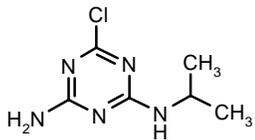
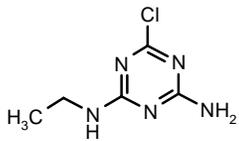
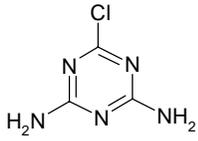
Compound	Structure	CAS No.	PC Code
Atrazine		1912-24-9	080803
Simazine		122-34-9	080807
Propazine		139-40-2	080808
Tribenuron-methyl (Express)		101200-48-0	128887
2-Hydroxyatrazine		2163-68-0	—

Table 3. Structures of the Compounds in the Candidate Group (Continued)

Compound	Structure	CAS No.	PC Code
Desethyl Atrazine (DEA)	 <chem>CC(C)Nc1nc(Cl)c(N)n1</chem>	6190-65-4	-
Desisopropyl Atrazine (DIA)	 <chem>CNc1nc(Cl)c(N)n1</chem>	1007-28-9	-
Diaminochlorotriazine (DACT)	 <chem>Nc1nc(Cl)c(N)n1</chem>	3397-62-4	-

III. Mechanism of Toxicity

This section describes the proposed mechanism for the common toxic endpoints by which the compounds containing the s-triazine moiety might be grouped. The triazine compound atrazine has been used as a prototype for defining the toxic effects of triazines and elucidating the mechanism of toxicity associated with these effects, given that it is the most extensively studied triazine. Multiple studies on the effects of atrazine have been published in open literature and conducted by registrants and EPA's National Health and Environmental Effects Research Laboratory (NHEERL). These studies demonstrate that the most relevant endpoint selected for intermediate-term and chronic risk assessments is a neuroendocrine effect exemplified in female rats by attenuation of the luteinizing hormone (LH) surge and accompanying disruption of the estrous cycle. In depth reviews and discussions of these studies may be found in the following documents:

- 1) Revised Preliminary Human Health Risk Assessment (http://www.epa.gov/pesticides/reregistration/atrazine/revsd_pra.pdf) (US EPA, 2001a).
- 2) Atrazine: Toxicology Chapter of the Reregistration Eligibility Decision. REVISED, (http://www.epa.gov/pesticides/reregistration/atrazine/tox_chapter.pdf) (US EPA, 2001b).
- 3) Hazard and Dose-Response Assessment and Characterization of Atrazine (Part A), Hazard Assessment and Review of Available Studies (Part B), and References, http://www.epa.gov/scipoly/sap/2000/june27/finalparta_atz.pdf and http://www.epa.gov/scipoly/sap/2000/june27/finalpartb_atz.pdf (US EPA, 2000a; US EPA 2000b).
- 4) SAP Report No. 2000-05, Atrazine: Hazard and Dose-Response Assessment and Characterization, http://www.epa.gov/scipoly/sap/2000/june27/finalpartc_atz.pdf (US EPA, 2000c).

A few of the more recent and pertinent studies are reviewed in this document in order to establish this neuroendocrine effect as relevant to a toxic effect common among several of the compounds containing the s-triazine moiety and their metabolites, and to establish its mode of action. However, the reader is referred to the citations above for more extensive reviews.

The carcinogenic effects of atrazine have been clearly demonstrated. The earliest published study documenting these effects showed that there were dose-related increases in the incidence and/or early onset of mammary gland tumors (adenomas, adenocarcinomas, and carcinosarcomas combined) in female Sprague-Dawley (SD) rats in a seminal carcinogenicity test performed with atrazine (Mayhew *et al.*, 1986). No dose-related increases in tumor responses were observed in male SD rats. Results of subsequent bioassays, some of which included serial and/or one year

sacrifices, confirmed that the predominant response observed following testing of atrazine in female SD rats is an increase in the incidence and/or early onset of mammary gland adenomas/carcinomas. Less compelling evidence suggests that there is decreased latency for the formation of mammary gland fibroadenomas and pituitary adenomas (Thakur, 1991a and 1992a; Pettersen and Turnier, 1995) and an increased incidence of mammary gland fibroadenomas (Morseth, 1998). An increased tumor incidence is not found at any other site in female SD rats, or at any site in male SD rats, or in either sex of Fischer 344 rats and CD-1 mice (Mayhew *et al.*, 1986; Hazelette and Green, 1987; Thakur, 1992a,b). Mammary gland tumors were reported in one study in male Fischer 344 rats that involved lifetime treatment with atrazine (Pinter *et al.*, 1990), but the finding is difficult to evaluate in light of the experimental design and shortcomings of the study. Furthermore, this finding is in conflict with the results of a conventional 24-month carcinogenicity study with F344 male rats that showed no increases in mammary gland tumors (Thakur, 1992b). The closely related structural analogues to atrazine (i.e., simazine, propazine, and cyanazine) also produce mammary gland tumors in the female SD rat but no other tumors of any type in the female SD rat and no tumors of any kind in the male SD rat or in CD-1 mice of either sex.

As a result of the above-mentioned studies with atrazine, a central nervous system (CNS) mechanism of toxicity has been proposed for the increased incidence of mammary gland tumors. It is hypothesized that the carcinogenicity of atrazine is a consequence of the disruption of the normal secretory activity of the hypothalamic-pituitary-ovarian axis. Figure 2 illustrates the proposed mode of action of atrazine in female SD rats on the activity of the hypothalamic-pituitary-ovarian axis and the development of mammary gland and to some extent pituitary neoplasms. As depicted in Figure 2, atrazine exposure affects the hypothalamus, leading to a decreased secretion of hypothalamic norepinephrine (NE) (Cooper 1998). Decreased NE levels result in decreased release of gonadotropin releasing hormone (GnRH) from the hypothalamus (Cooper, 1998). GnRH is the hormone responsible for inducing the pituitary gland to release luteinizing hormone (LH). Thus, a decreased GnRH level leads to an attenuated LH release (Cooper *et al.*, 1995, 1996, 2000; Morseth, 1996a, b). LH normally provides a signal to the ovaries promoting ovulation, but under atrazine's exposure serum LH levels are insufficient to stimulate ovulation. Under the tonic secretion of LH and follicle-stimulating hormone (FSH), this feedback mechanism eventually causes the ovarian follicles to continue to secrete estradiol, which in turn leads to the hypertrophy of pituitary lactotrophs and consequently the increase in prolactin secretion. In concert with prolactin, estrogen acts on the mammary gland and increases the risk for mammary gland tumors.

Suppression of the LH surge in female SD rats is considered to be a necessary precursor for the development of atrazine-induced mammary gland tumors. This is because LH blood levels must reach a sufficient magnitude to induce ovulation and to maintain normal reproductive cycles. When atrazine reduces LH output to the critical point where there is not enough to trigger ovulation, a physiological state results which is characterized by prolonged or persistent estrus. This state leads to continued stimulation of mammary tissue by estrogen. Evidence for an attenuation of the LH

surge and an early onset of prolonged and/or persistent estrus is provided in several studies (Morseth 1996a,b; Thakur 1991a; Eldridge *et al.*, 1993). Removal of the estrogen stimulus by ovariectomy completely abolishes the formation of mammary gland tumors following chronic administration of atrazine (Morseth, 1998). Estrogen has been strongly implicated in mammary gland cell proliferation and the enhancement of neoplastic transformation in rodents and humans (for review see Russo and Russo, 1996; Nandi, 1995).

It should be noted, however, that the proposed carcinogenic mode of action for atrazine in rats is not likely to be relevant to humans. As summarized by the FIFRA Scientific Advisory Panel (SAP), “there are considerable differences between hypothalamic-pituitary-ovarian function in rats and humans, and the effects of aging on the function of the axis also is quite dissimilar. Therefore, it is unlikely that the mechanism by which atrazine induces mammary gland tumors in female SD rats could be operational in humans. Nevertheless, it is not unreasonable to expect that atrazine might cause adverse effects on hypothalamic-pituitary function in humans” (US EPA, 2000c). Although the cancer mode of action may not be operative in humans, the SAP went on further to state that “the same endocrine perturbations that induce tumors also appear to play a role in at least some reproductive developmental effects”, which may be relevant to humans (See Figure 2).

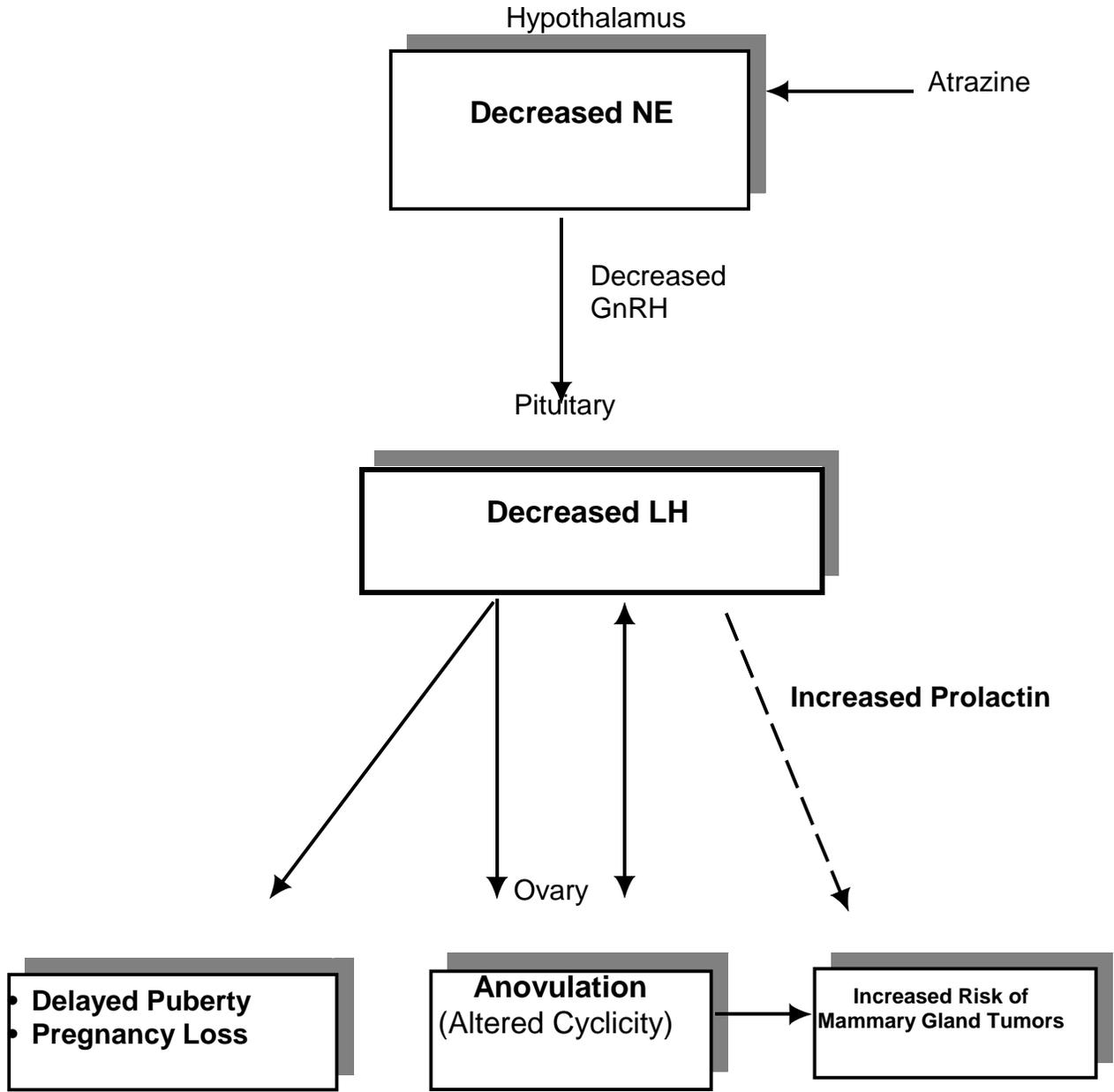
In addition to the disruption of the estrous cycle, the suppression of LH by atrazine has been found to be accompanied by adverse reproductive functions (discussed later in Section IV). Studies designed to evaluate the effect of atrazine on early pregnancy found that atrazine increased pre- and post-implantation loss and delayed parturition in various strains of female rats (Cummings *et al.*, 2000; Narotsky *et al.*, 2001). Further, it has been found that pubertal development is delayed in male and female Wistar rats administered atrazine (Laws *et al.*, 2000; Stoker *et al.* 2000 and in press).

Alternative modes of action for the neuroendocrine effects following exposure to compounds containing the s-triazine moiety have been suggested. Although several studies have found that the estrogenic effects associated with some of the compounds containing the s-triazine moiety *in vivo* are not estrogen receptor-mediated (Tennant *et al.*, 1994a,b; Conner *et al.*, 1996), these effects may be explained partly by their ability to induce aromatase, the enzyme responsible for converting androgens to estrogens. Recent studies demonstrated that atrazine, simazine and propazine, but not metabolites, DEA or DIA, induced aromatase activity in various cell lines (Sanderson *et al.*, 2001, 2000). Further, as raised by Trentacoste (2001) and by one member of the SAP (US EPA 2000c), it has been suggested that the anorexic effects of atrazine could account for most of atrazine’s effect on LH since reduced food intake and weight loss is a potent stimulus for reduced LH secretion. However, in pair-fed studies in both males and females, decreased food consumption and body weight could not account for the adverse effects of atrazine on the estrous cycle and pubertal development (Laws *et al.*, 2000; Stoker *et al.*, 2000) Upon consideration of the SAP comments, OPP’s own reviews and the data underlying these reviews, as well as additional information received by the Agency from registrants or presented in open literature, it has been

concluded that the neuroendocrine actions of atrazine are the primary and requisite mode of action for the induction of mammary gland tumors and certain reproductive developmental effects (see Figure 2).

Given the overall consistency and specificity of the evidence for atrazine's proposed mechanism of toxicity, studies on the effects associated with disruption of the hypothalamic-pituitary-gonadal axis have been conducted with the other compounds containing the s-triazine moiety (e.g., propazine, simazine, and certain chloro-s-triazine metabolites). Similar to atrazine, some of these compounds have been found to produce mammary gland tumors only in female SD rats and affect the hormonal control of reproductive functions. The attenuation of the pituitary LH surge and induction of reproductive developmental effects will be the basis upon which a common mechanism of toxicity will be determined for the candidate group, as established in the rest of this document.

Figure 2. Atrazine¹: Neuroendocrine Mode of Action and Associated Effects Found in Rats.



¹Atrazine also produced a decrease in pituitary prolactin, which also contributes to effects on reproductive development and affects lactation; NE = norepinephrine; LH=luteinizing hormone; GnRH = gonadotropin releasing hormone.

IV. Lines of Evidence

A. Structure Activity Considerations

In general, based on structure-activity relationships (SAR), the pesticides may be grouped according to their likelihood to generate a common type of toxic molecule or reactive intermediate or their ability to mimic a common biologically active molecule that interferes with the normal homeostasis of the cell (e.g., via receptor binding, enzyme induction, etc.).

As shown in Table 3, all compounds in the candidate group share an s-triazine ring in their structure. All compounds, except tribenuron methyl (Express) and 2-hydroxyatrazine, have a chlorine atom in the 2-position with alkyl amino groups at the 4- and 6- positions (atrazine, simazine, and propazine) or at either the 4- (DEA) or 6- (DIA) positions only. Diaminochlorotriazine (DACT) is the fully dealkylated triazine of the group. This compound is a common metabolite of atrazine, simazine, and propazine in the rat, and can, like its parental precursors, decrease the intensity of the LH surge in female rats.

Based on structure-activity considerations, it is reasonable to expect that three of the candidate herbicides, atrazine, propazine, and simazine may share common toxic effects, metabolic pathways, and mechanism(s) of action. Atrazine and propazine share a common metabolite, desethyl atrazine (DEA), while atrazine and simazine share desisopropyl atrazine (DIA) as a common metabolite. A further dealkylation of the desethyl- or desisopropyl atrazine yields diaminochlorotriazine (DACT), which is thus common to all three chlorotriazines. Atrazine can also lose its chlorine atom to form 2-hydroxyatrazine; however, as shown in Table 1, this compound does not induce mammary gland tumors in SD female rats.

B. Metabolism and Pharmacokinetics Considerations

Metabolism and pharmacokinetics considerations can play an important role in determining common mechanisms of toxicity in a candidate set of chemicals. Information on the disposition of a chemical helps to elucidate issues of target site dose delivery. The study of the biotransformation of the chemicals can determine if a putative common toxic metabolite or its precursor are produced.

As discussed below, the candidate group compounds have many metabolic similarities, as well as some differences.

1. Absorption

Absorption of the candidate group herbicides after oral dosing, as measured indirectly in laboratory studies, is significant and may impact the potential human dose from water and food exposures. Measurement of excretion of radioactivity in urine of rats (an approximate measure of absorption) for (14)-C-labeled atrazine demonstrated 67% of the dose was excreted through the urine (Timchalk *et al.*, 1990). The urinary excretion profiles for the some of the candidate group compounds are listed in Table 4.

The percentage of administered triazine dose excreted is similar for atrazine and propazine (Table 4). Excretion in urine for simazine was slightly smaller, 49.3% of the dose, and that of 2-hydroxyatrazine was slightly higher. Since Table 4 compares data from studies conducted under different protocols, it is difficult to assess the significance of differences in excretion times and profiles; however all of them are consistent with extensive absorption of the test material by the oral route.

Oral administration of the sulfonyl urea Express to Crl:CD:BR rats resulted in urinary excretion of over 60% of the dose.

Table 4. Urinary Excretion for (14)-C -s-Triazines by Orally Dosed Rats

Compound	Oral Dose	% Dose Excreted	Reference
Atrazine	~ 1.5 mg/kg	65.5 (72 hrs)	Bakke et al. (1972)
Atrazine	30 mg/kg	67 (72 hrs.)	Timchalk <i>et al.</i> (1990)
Atrazine	Unspecified	65 (72 hrs.)	Trochimowitz <i>et al.</i> , (1994)
Simazine	1.5 mg/kg	49.3 (96 hrs.)	Simoneaux and Sy (1971)
Propazine	1.0 mg/kg	69.5 σ /68.8 f (7d)	Krautter (1995)
Propazine	41-56 mg/kg	66 (72 hrs.)	Bakke <i>et al.</i> (1967)
2-OH - Atrazine	~1.5 mg/kg	78 (72 hrs.)	Bakke et al. (1972)

2. Tissue Distribution

Tissue residue analysis in rats dosed with radiolabelled atrazine, simazine or propazine indicate extensive tissue distribution of radioactivity from these compounds to sites, including the brain. Paul et al. (1993) administered a single oral dose of ¹⁴C -atrazine (1 mg/kg) to male SD rats. At 24 hours after dosing, percent of dose in heart, lungs, brain, liver,

and testes amounted to 0.22, 0.35, 0.49, 3.9, and 0.63 % of the dose, respectively. Radioautography of rats treated with a single oral dose of ¹⁴C -atrazine (100 mg/kg) showed extensive distribution of label throughout the body, including the brain and adjacent tissues. Orr and Simoneaux (1986) administered a single oral dose of ¹⁴C -simazine (0.5 mg/kg) to CD rats of both sexes. At 7 days after dosing, percent of dose in heart, lungs, brain, liver and uterus in females amounted to 0.04, 0.05, 0.10, 1.26, and 0.01 % of the dose, respectively. Corresponding values for males were 0.04, 0.06, 0.09, 1.08, and 0.01 (for testes), respectively. Bakke et al. (1967) administered a single oral dose of ¹⁴C -propazine (~ 49 mg/kg) to male SD rats. At 2 days after dosing tissue residues in heart, lung, brain, liver and spleen amounted to 51, 51, 34, 52 and 47 ppm (as propazine equivalents), respectively.

3. Biotransformation

All of the candidate group compounds undergo extensive biotransformation in rats. As summarized below, numerous metabolites have been detected in both rat and human urine, many of which are the same. As illustrated for atrazine (Figure 3), the main biotransformation pathways for the chloro-s-triazines in rats are N-dealkylation by the hepatic cytochrome P450 system, and glutathione conjugation of either the parent or the N-dealkylated metabolite to the ultimately excreted mercapturic acid conjugate (Figure 3). Express, a sulfonyleurea triazine, likewise undergoes extensive biotransformation.

a. Atrazine

The N-dealkylated urinary metabolites of atrazine in rats were quantitated by Bradway and Moseman (1982). As specified in Table 5, the major metabolite was diaminochlorotriazine (DACT). The minor metabolites, (desisopropyl s-triazine (DIA) and desethyl s-triazine (DEA), were detected in the higher dose groups.

Rat metabolism of atrazine was also studied by Timchalk *et al.* (1990). Fischer 344 rats were given a single oral dose of 30 mg (¹⁴C)-labeled atrazine per kg of body weight. The atrazine was quickly metabolized as the urine excreted within 24 hours of the dosing contained approximately 57% of the administered radioactivity. As shown in Table 5, the major urinary metabolite was DACT. The other reported urinary metabolites were DACT-mercapturate, DIA, DEA, and DEA-mercapturate. These metabolites were identified based upon similar HPLC retention times as synthesized standards (Timchalk *et al.*, 1990). Paul *et al.* (1993) found levels of DACT up to 25% of the dose in rats (Table 5).

As shown in Figure 4, atrazine, simazine, and propazine share N-dealkylation metabolic pathways and thus these three compounds have the metabolite diaminochlorotriazine (DACT) in common. As will be discussed later, DACT causes a decrease in the LH surge in SD female rats and produces effects on reproduction and development.

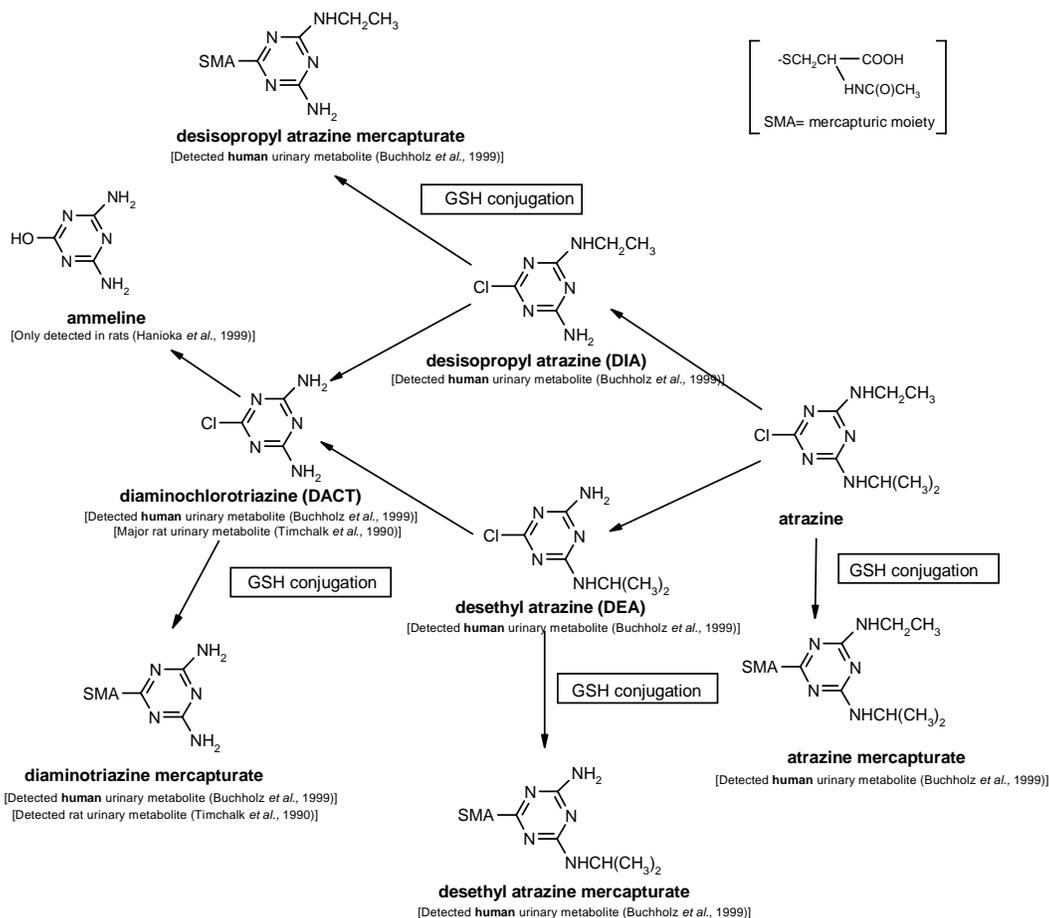


Figure 3. Biotransformation for Atrazine [Adapted from Buchholz *et al.* 1999, Hanioka *et al.* 1999, and Timchalk *et al.* 1990].

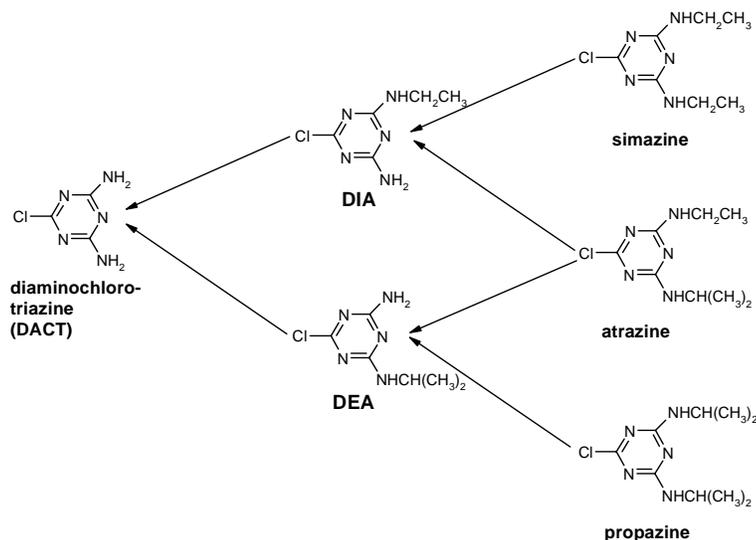
Table 5. Relative Percentage(s) of (14)-C Atrazine² Urinary Metabolites

Reference	Species	Route	Dose Level	Metabolite(s) ¹	% Administered Dose Excreted in Urine as Metabolite(s)	Notes
Bradway and Moseman, 1982	Rat Males F344	Oral, Single Dose	170 mg/kg	DACT DIA & DEA	Not Measured 3.7%	Results not reported separately for DIA & DEA. DACT not studied.
			17 mg/kg	DACT DIA & DEA	Not Measured 0.3%	
			1.7 mg/kg	DACT DIA & DEA	Not Measured Not Detected	
Bradway and Moseman, 1982	Rat Males F344	Oral, For Days 1, 2 & 3	17 mg/kg/day	DACT	3.2% (day 1), 31.9% (day 3)	No DACT recovered at doses of 0.17 & 0.017 mg/kg/day
			1.7 mg/kg/day	DACT	2.9 % (day 1) 4.3 % (day 3)	
Paul et al. 1993 (MRID 44713802)	Rat Males SD	Oral, Single dose	1 mg/kg	DACT DACT-mercapturate DIA DEA	25.8 % 1.1% 0.2 % 0.07 %	
			100 mg/kg	DACT DACT-mercapturate DIA DEA	14.2 % 2.5% 0.8 % 0.2 %	
Timchalk <i>et al.</i> , 1990	Rat Males SD	Oral, Single dose	30 mg/kg	DACT DACT-mercapturate DIA DEA-mercapturate DEA	39% (67%) ³ 5% (9%) ³ <0.6% (<1%) ³ 8% (13%) ³ 3% (5%) ³	Data from urine extracts from 0 to 24 hours after dose

¹ See Figures 3 and 4 for structural identity of metabolites

² Bradway and Moseman used non-radiolabelled atrazine

³ Percentage of total urinary radioactivity



[Figure adapted from Hanioka et al., 1999]

Figure 4. Dealkylation of Simazine, Atrazine, and Propazine

b. Propazine

As summarized in Table 6, the dealkylated urinary metabolites of propazine in rats were quantitated by Bradway and Moseman (1982). The major metabolite was DACT; and a second metabolite, DEA, was detected in the higher dose groups (Bradway and Moseman, 1982).

c. Simazine

The dealkylated urinary metabolites of simazine in rats were quantitated by Bradway and Moseman (1982). As specified in Table 6, the major metabolite was DACT. A second metabolite, DIA, was detected at a lower level (Bradway and Moseman, 1982).

Table 6. Relative Percentage(s) of Propazine and Simazine Urinary Metabolites

Compound	Reference	Species	Route	Dose Level	Metabolite(s) ¹	% Administered Dose Excreted in Urine as Metabolite(s)
Propazine	Krautter, 1995 (MRID 43689801)	Rat Male & Female SD	Oral Single Dose	1 mg/kg	DACT 2-OH-DEA DEA	28.8 % ♂, 26.9 % ♀ 2.6% ♂, ND ND ♂, 0.7% ♀
				100 mg/kg	DACT 2-OH-DEA DEA	28.2 % ♂, 19.9 % ♀ ND ♂, ND ♀ 0.9% ♂, ND ♀
Propazine	Bradway and Moseman, 1982	Rat Males F344	Oral Single dose	170 mg/kg	DACT DEA	Not Measured 0.5%
				17 mg/kg	DACT DEA	Not Measured 0.08%
Propazine	Bradway and Moseman, 1982	Rat Males F344	Oral, For Days 1, 2 & 3	17 mg/kg/day	DACT	3.3% (day 1) 9.6% (day 3)
				1.7 mg/kg/day	DACT	0.34% (day 1) 17% (day 3)
Simazine	Bradway and Moseman, 1982	Rat Males F344	Oral Single dose	170 mg/kg	DACT DIA	Not Measured 2.8%
				17 mg/kg	DACT DIA	Not Measured 0.5%
				1.7 mg/kg	DACT DIA	Not Measured 0.4%
Simazine	Bradway and Moseman, 1982	Rat Males F344	Oral, For Days 1, 2 & 3	17 mg/kg/day	DACT	3.9% (day 1) 18.2% (day 3)
				1.7 mg/kg/day	DACT	1.4% (day 1) 1.6% (day3)

¹ See Figures 3 and 4 for structural identity of metabolites

d. Tribenuron methyl (Express)

As shown in Figure 5, Express undergoes extensive biotransformation in rats. In Crl:CD:BR rats dosed orally with ^{14}C -triazine-ring labeled Express recoveries of O-demethyl triazine amine, N-demethyl triazine amine and triazine amine in female urine amounted to 12.2, 3.4 and 3.4 percent of the dose. These values suggest extensive metabolic release of the triazine moiety in the dosed animals.

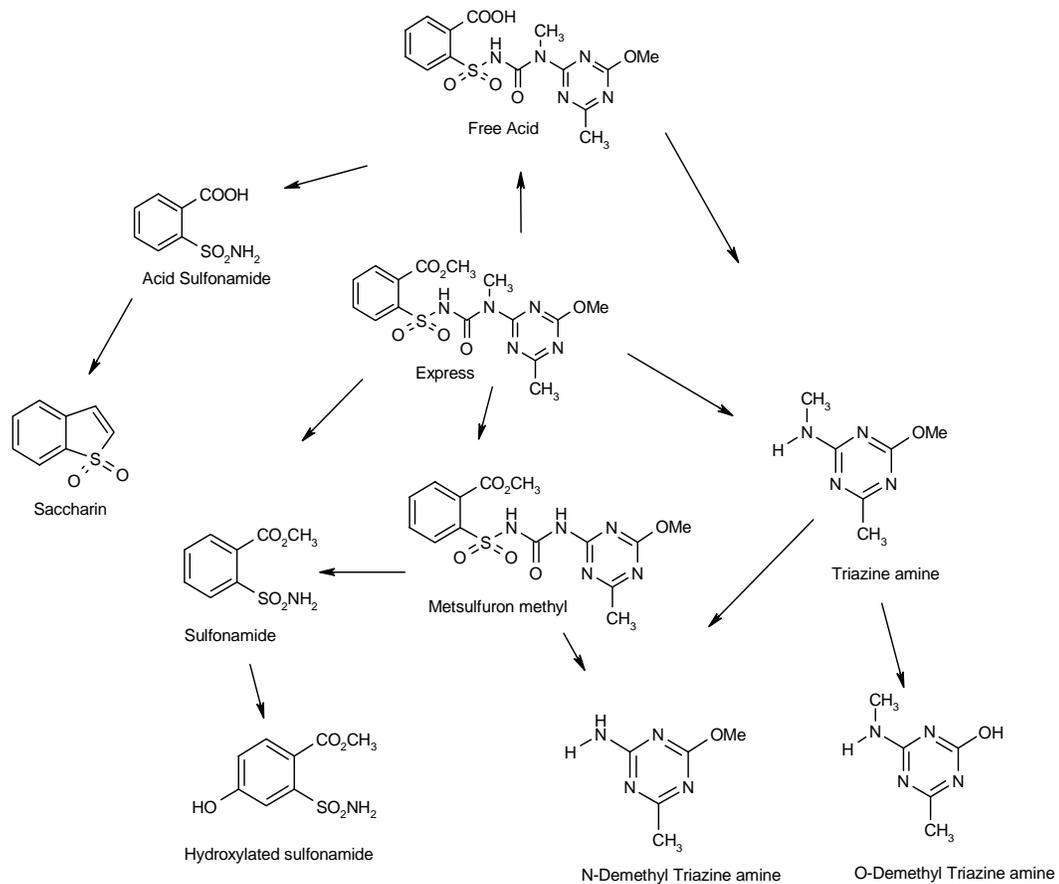


Figure 5. Biotransformation of Express in Rats (Adapted from MRID 40245516)

4. Summary

The previous sections describe the absorption, biotransformation and excretion profiles for the candidate compounds and their metabolites. All of the candidate group compounds are significantly absorbed by rats when administered orally. The main biotransformation pathways identified through excretion profiles involve hepatic cytochrome P450-mediated N-dealkylation and glutathione conjugation of either the dechlorinated or the N-dealkylated metabolite. Biotransformation of atrazine, simazine, and propazine, but not Express, results in the common metabolites DACT and/or DIA and DEA.

C. Toxicological Considerations

The identification of a candidate group of chemicals for a cumulative risk assessment involves an evaluation of effects that may be common to the group of chemicals under review. Following is a discussion of the relevant types of effects reported to be induced by treatment of laboratory animals with compounds containing a triazine moiety and an evaluation of the extent to which the effects are common to this group of chemicals. Hematological and cardiac effects following exposure to compounds containing a triazine moiety are not consistent and not associated with disruption of the hypothalamic-pituitary-gonadal axis, and therefore are not included in this discussion. Furthermore, developmental effects (e.g., incomplete or delayed ossification) are not discussed because there are no data that would suggest that the delays in ossification in fetal animals are due to disruption of the hypothalamic-pituitary-gonadal axis or any other common mechanism by the candidate group compounds. Although the disruption of the hypothalamic-pituitary-axis is plausible in humans, data from human studies are insufficient to rely on for this common mechanism assessment. Thus, this analysis only utilizes data from laboratory animals as a basis of grouping these compounds by a common mechanism of toxicity. The effects likely related to neuroendocrine disruption observed in *in vivo* studies with the candidate group compounds are summarized in Table 7 and discussed below.

Table 7. Neuroendocrine Effects Following Exposure to the Candidate Group

Toxic Effects	Atrazine	Simazine	Propazine	Express	HA ¹	DACT	DIA	DEA
Carcinogenicity								
Increased incidence of mammary gland tumors	Yes	Yes	Yes	Yes	No	Yes	no data	no data
Reproductive Developmental and Neuroendocrine								
Disruption of the estrous cycle	Yes	no data	no data	Yes	no data	Yes	no data	no data
Attenuation of LH surge	Yes	Yes	Yes	no data	no data	Yes	no data	no data
Attenuation of prolactin surge	Yes	no data	no data	no data	no data	no data	no data	no data
Delayed vaginal opening	Yes	no data	Yes	no data	No	Yes	no data	no data
Altered pregnancy outcome	Yes	no data	no data	no data	Yes	Yes	Yes	Yes
Delayed preputial separation	Yes	no data	no data	no data	Yes	Yes	Yes	Yes
Decreased testosterone	Yes	no data	no data	no data	no data	no effect	Yes	no effect
Decreased prostate weight	Yes	no data	no data	no data	no data	Yes	Yes	Yes
Prostatitis in offspring	Yes	no data	no data	no data	no data	no data	no data	no data
Increase or decrease in testes weight	Yes	Yes	Yes	no data	no data	no effect	Yes	Yes

¹ HA = 2-hydroxyatrazine

1. Carcinogenic Effects

Studies submitted to OPP report that mammary gland tumors in female rats are a characteristic common effect in studies conducted with candidate group compounds. The studies provide evidence that administration of these compounds to female SD rats leads to increased incidence and/or early onset of benign and mammary gland carcinomas and adenomas, mammary gland fibroadenomas, and pituitary adenomas (Table 8). As discussed earlier, mammary gland tumors are not likely to be relevant to humans. However, because mammary gland tumors are associated with attenuation of the LH surge they are an indicator of the common mechanism of toxicity.

As shown in Table 8, the carcinogenicity of atrazine in the female Sprague-Dawley (SD) rat has been confirmed in several two-year bioassays. These studies show that atrazine exposure results in an increased incidence and an early onset of mammary gland tumors in female SD rats (Mayhew *et al.*, 1986; Thakur, 1991a, 1992a; Pettersen and Turnier, 1995). However, no tumor response is seen in SD male rats, Fischer 344 rats, or CD-1 mice of either sex (Hazelette and Green, 1987; Thakur, 1991b; Thakur, 1992b). The lowest dose of atrazine associated with an increased incidence in mammary gland carcinomas is 3.5 mg/kg/day (Mayhew *et al.*, 1986).

Similar findings are also seen with simazine and propazine. In a combined chronic/carcinogenicity study, simazine at dose levels of 100 ppm (5.3 mg/kg/day) and 1000 ppm (45.8 mg/kg/day) resulted in a statistically significant dose-related trend in mammary gland carcinomas (McCormick *et al.*, 1988). A higher incidence of mammary gland carcinomas was also seen in the recovery substudy (52 weeks of treatment with 1000 ppm followed by 52 weeks of recovery) for the control and high dose group (1/10 vs 4/10, respectively). Propazine at low and high doses was found to increase the incidence of mammary gland tumors in female SD rats following the administration of propazine in the diet at 0, 3, 100, or 1000 ppm for 2 years (Jessup, 1980).

In a chronic/carcinogenicity study Express was fed to SD rats in the diet at 0, 25, 250, and 1250 ppm for 2 years (Tobia, 1987). A statistically significant increase in mammary gland adenocarcinomas was observed in the highest dose group (1250 ppm) after two years of Express exposure. The LOAEL for this study was 250 ppm, based on body weight gain, and the NOAEL was 25 ppm.

There have been no studies submitted to the Agency on the carcinogenicity of the triazine metabolites DEA and DIA. Recent data submitted to OPP in a draft report indicate that DACT at 200 ppm increased the incidence of mammary gland tumors in female SD rats

(Minnema, 2002). There were no effects of DACT on mammary gland tumor incidence at feeding levels equal to or less than 25, 50, or 70 ppm. There was no increase above control levels in the incidence of mammary gland tumors or tumors of any type in a two-year chronic/carcinogenicity study on 2-hydroxyatrazine (Chow and Hart, 1995).

Table 8. Summary of Female Mammary Gland Tumor Incidence/Onset in Chronic Rat Bioassays Using Candidate Group Compounds

Study	Species/ Strain	Duration	Mammary Gland Tumor Incidence	Mammary Gland Tumor Onset
Mayhew <i>et al.</i> , 1986	Rat/SD	2 year (atrazine)	Statistically-significant increase in female carcinomas at 3.5 mg/kg/day when adjusted for survival	Not determined in this study
Thakur, 1991a	Rat/SD	2- year with serial sacrifices (atrazine)	A significant positive trend for fibroadenomas is seen.	The percentage of carcinomas occurring in the first year of the study was 0 in controls, 33% at 4.23 mg/kg/day, and 50% at 26.23 mg/kg/day.
Thakur, 1992a	Rat/SD	2- year (atrazine)	No statistically-significant increases in female fibroadenomas or carcinomas seen at either 3.79 or 24.01 mg/kg/day	The percentage of carcinomas and adenomas occurring in the first year of the study in controls was 0% while at 3.79 mg/kg and 23.01 mg/kg/day 27.3 and 33.3% of the carcinomas appeared in the first year of the study.
Pettersen and Turnier, 1995	Rat/SD	1-year (atrazine)	six carcinomas/adenomas and four fibroadenomas are seen at the 23.9 mg/kg/day group compared to one carcinoma and two fibroadenomas in the control group.	The increased incidence of tumors at one year indicates an earlier onset.
McCormick <i>et al.</i> , 1988	Rat/SD	2-year (simazine)	Statistically significant increase in female carcinomas and fibroadenomas at 100 ppm and 1000ppm	A higher incidence of mammary gland carcinomas was observed in the recovery group (52 weeks of treatment, followed by 52 weeks of recovery)
Jessup, 1980	Rat/SD	2-year (propazine)	Mammary gland tumors (adenocarcinomas and adenomas) were increased in low- and high-dose female groups (3 and 1000ppm).	Not altered in propazine exposed animals
Tobia, 1987	Rat/SD	2-year (Express)	Statistically significant increase in mammary gland adenocarcinomas was observed in the highest dose group (1250 ppm)	Not altered in Express exposed animals
Minnema, 2002	Rat/SD	1-year (DACT)	Statistically significant increase in the incidence of mammary gland tumors at 200 ppm.	Not determined in this study

2. Reproductive Developmental and Neuroendocrine Effects

Effects on Females

As shown in Table 9a, the candidate group of compounds have all been found to produce reproductive developmental effects in female rats. Some of these effects include an attenuation of the LH surge and disruption of the estrous cycle. Other effects observed include attenuation of prolactin release, altered pregnancy outcome, and delayed puberty in male and/or female rats. Although Express has been found to act as an estrogen agonist (Cook, 1989), the reproductive developmental effects of atrazine, simazine, and DACT (Tennant *et al.*, 1994a,b; Conner *et al.*, 1996) does not appear to be a result of estrogenic activity. The estrogenic activity of propazine has not been determined.

Evidence for an attenuation of the LH surge following exposure to compounds containing the s-triazine moiety is provided in several studies (Cooper, unpublished data; Minnema, 2001ab; Cooper *et al.*, 1995,1996, 2000; Cummings *et al.*, 2000; Morseth 1996ab). In a recent study submitted to US EPA, Minnema (2001a) compared the effects of simazine, DACT, and atrazine on LH. Simazine, DACT, and atrazine were administered to 20 Sprague-Dawley Crl:CD BR female rats/dose/group by oral gavage at dose levels of 0, 2.5, 5, 40, 200 mg/kg/day once daily for at least 4 weeks. Results showed that all three compounds had similar effects on diminishing the peak LH when the peak for each animal was determined and time axis for the individual animal data was rescaled to zero time. All three compounds at the two highest doses, 40 and 200 mg/kg/day, significantly decreased adjusted peak LH surge. Moreover, unpublished data by US EPA laboratory (Cooper, unpublished data) show that propazine (300.0 mg/kg/day) decreases the LH surge by over 50% of control. However, a pilot study submitted to OPP comparing propazine with atrazine and DACT found that propazine (320.1 mg/kg/day) decreased the peak LH surge to only 78.7% of control, whereas the mean LH peak surges were decreased to 34.5 and 47.6% of control following atrazine and DACT, respectively (Minnema, 2001b).

When the LH surge is analyzed using the maximum increase in plasma LH over baseline level (LHMax), hour at which peak surge of LH occurred (TimeMax), and area under the curve for LH verses time profile (AUC), the effects of the simazine, DACT, and atrazine on LH surge differ. Evaluation of LHMax, TimeMax, and AUC in a 28-day oral gavage study found that simazine at 40 and 200 mg/kg/day and DACT at 200 mg/kg/day significantly decreased LHMax and AUC (Minnema 2001a). Atrazine had no effects on any of the parameters at any dose level. Further, in a one-year chronic study with atrazine, DACT, and

simazine, attenuation of LH surge, as measured by LHMax and AUC, was only observed at the highest dose level (1854 μ moles/kg feed) of DACT (Minnema, 2002). Hence, the use of these parameters as measures of LH surge yield inconsistent data with previous reports and may not represent an accurate measure of the effects of these compounds on LH surge. It should be noted that a recently submitted preliminary report on the effects of atrazine in monkeys on LHMax, rate of rise of LH, AUC, and TimeMax showed inconclusive evidence of atrazine's adverse effects on LH after either 5 or 26 days of treatment due to several confounding factors (e.g., a limited sample size and a higher degree of individual variability in LH measurements than expected) (Parshley, 2001).

The effects of candidate group compounds on reproductive and neuroendocrine functions have been further characterized by cyclicity, pregnancy outcome, and pubertal developmental studies. Atrazine and DACT have been shown to prolong the duration of the estrous cycle at relatively low doses (Morseth, 1996ab; Pettersen *et al.*, 1991). Additionally, Express has been shown to slightly prolong the estrous cycle, in addition to decrease the estrogen-binding affinity of receptors in the uterus and mammary glands, at a very high dose (5000 ppm) (Cook, 1989). It can be expected that, if the LH surge and/or the estrous cycle are affected by exposure to candidate group compounds, then puberty and/or pregnancy may also be affected. In fact, studies conducted by US EPA labs have shown that atrazine at 50, 100, and 200 mg/kg delayed vaginal opening 3.4, 4.5, or greater than 6.8 days and produced irregular cycles in female Wistar rats (Laws *et al.*, 2000). More recently, it was reported that propazine and DACT, but not 2-hydroxyatrazine, delayed vaginal opening by up to 4 and 7 days, respectively (Laws *et al.*, 2002). Although the effects of atrazine and the metabolites (i.e., 2-hydroxyatrazine, DACT, DEA, and DIA) on pregnancy outcome varies considerably based on rat strain, they have been found to induce pre- and post-implantation loss, full litter resorption and delayed parturition (Narotsky *et al.*, 2002, 2001; Cummings *et al.*, 2000). See Table 9a for a summary of these effects.

As previously mentioned, although Express induces mammary gland tumors and appears to affect the ovarian cycle in female rats, limited data suggest that it is an estrogen receptor agonist. In a subchronic study (Cook, 1989), female CrI:CD[®]BR rats (20/dose level) were fed Express at 0 or 5000 ppm (approximately 390 mg/kg bw/day) for 84 days. At termination, the rats fed 5000 ppm had statistically significantly reduced body weights and body weight gains with respect to controls. Mean relative organ weights for treated rats terminated in estrus were significantly higher than in controls for liver (35% higher), uterus (31%), and ovaries (29%); mean relative organ weights for rats terminated in diestrus were also statistical significantly higher than in

controls for liver and uterus. In addition, the number of rats with a prolonged estrus, number of rats with 2 or more prolonged estrous cycles, and the number of cycles with a prolonged estrus were statistically significantly elevated at 5000 ppm vs controls. Furthermore, using radiolabelled thymidine incorporation, it was shown that cell proliferation in the uterus was increased in the rats treated with 5000 ppm. The ability of Express and its metabolites to compete *in vitro* for binding to the estrogen receptors in the uterus was further demonstrated when Express (ester and acid, see Figure 6 for structures) and its metabolites (N-demethyl triazine amine, N-demethyl-6-hydroxymethyl-triazine amine, α -hydroxytriazine amine, sulfonamide urea and metsulfuron methyl; all at 1.0 mM) competed with Diethylestilbestrol (0.125 mM) for binding to the estrogen receptor. None of these competed significantly with R5020 (0.125mM) for binding to the progesterone receptor.

Effects on Males

The candidate group compounds appear to not have a consistent effect on male gonadal weight. Atrazine, simazine, propazine and/or their metabolites, DIA, DACT, and DEA have been shown in different studies to increase, decrease or have no effect at all on testes weight (Mainiero *et al.*, 1987; Tai *et al.*, 1985; Gerspach, 1991; Jessup, 1979; Thompson *et al.*, 1992). However, atrazine and the metabolites have been found to delay the onset of puberty in male rats (Stoker *et al.*, in press; Stoker *et al.*, 2000). Stoker *et al.* (in press) also demonstrated recently that DACT, DIA, and/or DEA reduced ventral and lateral prostate, seminal vesicle, and epididymal weights when administered PND 23 through 53. Furthermore, when atrazine was administered to peripubertal male SD rats (22 to 47 days of age) at doses of 1 to 200 mg/kg/d, serum and intratesticular testosterone levels were reduced in the 100 and 200 mg/kg/d groups, as were seminal vesicle and ventral prostate weights (Trentacoste *et al.*, 2001). In the same study, serum LH was also reduced, suggesting an effect on the hypothalamus, the pituitary gland or both. Deprivation of prolactin during the early postnatal stage in the male offspring of dams receiving >25 mg/kg/d atrazine resulted in an increased incidence and severity of prostate inflammation (Stoker *et al.*, 1999). See Table 9b.

Table 9a. Lowest NOAELs/ LOAELs (mg/kg/day) for Reproductive Developmental Effects Following Exposure to Candidate Group Compounds in Female Rats

Response	Rat Strain	Exposure Period	NOAEL/LOAEL	Reference
FEMALE				
Attenuation of LH surge	LE	Single dose	300 (propazine)	Cooper, unpublished data
	SD	7 single daily doses	320.1 (propazine) 300 (atrazine) 202.4 (DACT)	Minnema, 2001b
	SD	28 daily doses	not determined (simazine)* not determined (DACT)* not determined (atrazine)*	Minnema, 2001a
	LE LE LE SD	1 day dose 3 daily dose 21 daily dose 21 daily dose	200/300(atrazine) <50/50 (atrazine) <75/75 (atrazine) 75/150 (atrazine)	Cooper <i>et al.</i> , 2000
	HLZ LE	GD 1-8	50/100 (atrazine)	Cummings <i>et al.</i> , 2000
	SD	28 days	5/40 (atrazine)	Morseth, 1996a
	SD	6 months	1.8/3.65 (atrazine)	Morseth, 1996b
Altered pregnancy maintenance	F344 SD LE	GD 6-10	25/50 (atrazine) 100/200 (atrazine) 100/200 (atrazine)	Narotsky <i>et al.</i> , 2001
	F344 HLZ	GD 1-8 GD 6-10	50/100 (atrazine) 50/100 (atrazine)	Cummings <i>et al.</i> , 2000
	F344	GD 6-10	25/50 (atrazine) 34/68 (DACT) 87/131 (DEA) 40/80 (DIA) <91/91 (hydroxyatrazine)	Narotsky <i>et al.</i> , 2002
Delayed parturition	F344	GD 6-10	50/100 (atrazine) 17/34 (DACT) <44/44 (DEA) 40/80 (DIA) 457/>457 (hydroxyatrazine)	Narotsky <i>et al.</i> , 2002
	F344 SD LE	GD 6-10	50/100 (atrazine) 50/100 (atrazine) 200/>200 (atrazine)	Narotsky <i>et al.</i> , 2001
Delayed vaginal opening	Wistar	PND 22-41	16.5/33.7 (DACT) 53/107 (propazine)	Laws <i>et al.</i> , 2002
	Wistar	PND 22-41	25/50 (atrazine)	Laws <i>et al.</i> , 2000

* These data are still under review by OPP.

Table 9a continued

Response	Rat Strain	Exposure Period	NOAEL/LOAEL	Reference
Disruption of estrous cycle	Wistar	PND 22-41	25/50 (atrazine)	Laws <i>et al.</i> , 2000
	SD	26 weeks	50ppm/400ppm (atrazine)	Eldridge <i>et al.</i> , 1999
	SD	28 days	5/40 (atrazine)	Morseth, 1996a
	SD	6 months	1.8/3.65 (atrazine)	Morseth, 1996b
	SD	13 weeks	10/100 (DACT)	Pettersen <i>et al.</i> , 1991
	SD	13 weeks	0/5000 ppm (Express)	Cook, 1989
Attenuation of prolactin release	LE LE LE SD	Adult females single dose 3 daily doses 21 daily doses 21 daily doses	atrazine: 200/300 serum <50/50 pituitary <75/75 pituitary <75/75 pituitary	Cooper <i>et al.</i> , 2000
Dams prolactin decreased	Wistar	PND 1-4	13/25 (atrazine)	Stoker <i>et al.</i> , 1999

Table 9b. Lowest NOAELs/ LOAELs (mg/kg/day) for Reproductive Developmental Effects Following Exposure to Candidate Group Compounds in Male Rats

Response	Rat Strain	Exposure Period	NOAEL/LOAEL (mg/kg/day)	Reference
Males				
Decreased LH	SD	PND 22-47	100/200 (atrazine)	Trentacoste <i>et al.</i> , 2001
Decreased testosterone & prostate weight	SD	PND 22-47	50/100 (atrazine)	Trentacoste <i>et al.</i> , 2001
Delayed preputial separation	Wistar	PND 23-53	12.5/25 (DEA) 12.5/25 (DIA) 6.25/12.5 (DACT)	Stoker <i>et al.</i> , 2002 (in press)
	Wistar	PND 23-53	<12.5/12.5 (atrazine)	Stoker <i>et al.</i> , 2000
	Wistar	PND 23-53	<11.4/11.4 (hydroxyatrazine)	Stoker, unpublished data
Increased incidence of prostatitis in offspring	Wistar	PND 1-4	13/25 (atrazine)	Stoker <i>et al.</i> , 1999
Increased incidence and severity of prostatitis in offspring	Wistar	PND 1-4	25/50 (atrazine)	Stoker <i>et al.</i> , 1999

V. Weight-of-Evidence Evaluation for Grouping the Candidate Group by a Common Mechanism of Toxicity

Table 10 lists the key LH-dependent effects that are considered to be relevant in defining those candidate group compounds that can be considered to have a common mechanism of toxicity due to disruption of the hypothalamic-pituitary-gonadal axis (see Table 7 for additional neuroendocrine toxic effects following exposure to the candidate group compounds). The relevant lines of evidence for grouping are discussed in the following pages. The common toxic effects of the candidate group compounds whose toxic effects have not been fully established is inferred based on metabolism data.

Table 10. Evidence Used in Grouping/Excluding Candidate Group Pesticides by a Common Mechanism of Toxicity¹

Chemical	Mammary gland tumors	Suppress LH	Alter Cyclicity	Delay puberty	Alter pregnancy maintenance	Estrogen agonist
Atrazine	Yes	Yes male and female	Yes	Yes male and female	Yes	No
Simazine	Yes	Yes	No data	No data	No data	No
Propazine	Yes	Yes	No data	Yes	No data	No data
Express	Yes	No data	Yes	No data	No data	Yes
2-Hydroxyatrazine	No	No data	No data	No (females) Yes (males)	Yes	No data
DACT	Yes	Yes	Yes	Yes male and female	Yes	No
DEA	No data	No data	No data	Yes male	Yes	No data
DIA	No data	No data	No data	Yes male	Yes	No data

¹Effects are observed in females unless otherwise noted.

A. Mammary Gland Tumors

A mechanism for the development of mammary gland tumors in female SD rats treated with **atrazine** has been detailed in this document and in previously cited documents. In summary, mammary gland tumors in the female rat result from a disruption of hypothalamic neurotransmitter and neuropeptide (primarily noradrenergic) regulation of GnRH, and subsequently, LH secretion. The resultant endocrine milieu of enhanced or unopposed estrogen and prolactin secretion provides an environment that is conducive to the development of mammary gland tumors.

Among the compounds listed in Table 10, **atrazine, simazine, propazine, Express**, and the metabolite **DACT** have been found to produce mammary gland tumors in rats.

- ❑ Atrazine, simazine, and propazine are not only structurally very similar, but present the same pattern of species/strain of mammary gland tumors, i.e. all three produce mammary gland tumors in the female SD rat but no other tumors of any type in the female SD rat, male SD rat, or in CD-1 mice of either sex.
- ❑ **DACT**, a metabolite of atrazine, simazine, and propazine, at 200 ppm increased the incidence of mammary gland tumors in female SD rats following one year of exposure (Minnema, 2002).
- ❑ **Express** produced mammary gland tumors in female Tif:RAlf rats. However, it is not clear that the same LH-related mechanism is operative in this compound as it is for atrazine because results from *in vivo* experiments (e.g., increased uterine cell proliferation & increased relative uterine weights) and *in vitro* experiments (e.g., estrogen receptor binding) with Express and its metabolites suggest that Express acts as an estrogen agonist. Thus, given its estrogenic activity, Express **can not** be grouped based on a common mechanism of toxicity and will consequently be excluded from the common mechanism group.

B. Attenuation of LH Surge

Studies have shown that **atrazine, simazine, propazine** and the metabolite **DACT** suppress the LH surge in rats (e.g., SD, Long-Evans). Atrazine suppresses LH in both male and female animals. The proximal effects of atrazine that lead to decreased LH levels outcomes have been identified as decreased hypothalamic norepinephrine levels and diminished ability to release gonadotropin releasing hormone from the hypothalamus (Cooper *et al.*, 1998). Atrazine has also been found by these same authors to increase hypothalamic dopamine and subsequently decrease prolactin secretion. As previously described, these neuroendocrine alterations can produce a cascade of effects which may alter the excitatory and inhibitory pathways and feedback loops essential for hormonal control in the hypothalamic-pituitary-gonadal (HPG) axis. Alteration of these pathways following exposure to compounds containing the triazine moiety have been found to exert effects on hormonal control of the estrus cycle in females, pubertal development in both males and females, pregnancy outcome, and prolactin secretion in laboratory rats. Although there are no direct data indicating that **DEA** and **DIA** attenuate the LH surge, it appears reasonable to expect that they will do so since **DACT**, an LH surge attenuator, is a metabolite common to both DEA and DIA in rats. This contention is supported by data that show that both **DEA** and **DIA** alter pregnancy maintenance (see below), an effect that is attributed to interference with the hypothalamic-pituitary-gonadal axis.

C. Alteration of the Estrous Cycle

Atrazine, DACT, and Express have all been shown to disrupt the estrous cycle by prolonging the number of days in estrus. Atrazine can increase the percentages of days in estrus by as much as 70%. Dietary exposure to DACT for 13 weeks induced irregularities of the cycle, which included early, intermittent, or persistent proestrus, estrus, and diestrus. Although **Express** has been shown to slightly prolong the estrous cycle, results of *in vivo* experiments showed that this compound possesses estrogenic activity, and therefore may not be acting by the same mechanism as atrazine, simazine, and propazine, as mentioned earlier in this section

D. Delayed Pubertal Development

Atrazine, propazine, and metabolites 2-hydroxyatrazine, DACT, DEA, and DIA have been found to delay pubertal development in rats. Atrazine and DACT delay puberty in both male and female rats, while 2-hydroxyatrazine has been found to delay puberty in males but not females. In females, the administration of propazine from postnatal day 22 through 41 delayed vaginal opening by 4 days. Male rats exposure to DACT, DEA, or DIA during postnatal days 23-53 were found to show preputial separation and decreases in prostate weights.

E. Altered Pregnancy Maintenance

It is well known that the hormonal requirements of the corpus luteum (CL) change as the rat progresses through different stages of gestation. After the first week of gestation, the CL no longer requires prolactin for support and becomes dependent on LH during gestation days (GD) 7-16. During this time as little as 2-4 hours deprivation of LH may be sufficient to terminate pregnancy. **Atrazine** and the metabolites **2-hydroxyatrazine, DACT, DEA, and DIA** have been reported to alter pregnancy maintenance. These compounds have been found to induce full litter resorption, induce pseudopregnancy, prevent pre or post-implantation, and/or delay parturition. Although **2-hydroxyatrazine** has been shown to alter pregnancy and delay puberty in males, it has not been found to induce mammary gland tumors. Therefore, based on the absence of mammary gland tumor induction by 2-hydroxyatrazine and inconclusive data that show 2-hydroxyatrazine's effect on the LH surge and/or LH-dependent events, the WOE **does not** support including it in the common mechanism group at this time.

VI. Conclusions and Final Grouping of the Candidate Group Compounds Based on a Common Mechanism of Action

To satisfy the requirements of the Food Quality Protection Act of 1996 to assess the cumulative effects of chemicals that have a common mechanism of toxicity, OPP has determined that some of the candidate group compounds can be grouped based on a common mechanism of toxicity. Based upon the weight-of-evidence provided in studies by registrants and EPA laboratories and in studies reported in the literature, the pesticides **atrazine, propazine, simazine, and metabolites diaminochlorotriazine (DACT), desisopropyl s-atrazine (DIA), and desethyl s-atrazine (DEA)** should be considered as a **Common Mechanism Group**, based on suppression of the LH ovulatory surge and the consequent effects on reproductive function and development. Several compounds were excluded (including Express and 2-hydroxyatrazine) from this grouping on the basis of not having sufficient similarity to the remaining compounds with respect to metabolism, pharmacokinetics, and toxic effects (i.e., mammary gland tumors and/or neuroendocrine effects). Others were excluded because they were no longer a registered compound with the US EPA, had minimal human exposure, or were registered outside the United States. Following the initiation of a cumulative risk assessment, the Common Mechanism Group may be modified as a result of the review of new or existing data.

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