



A joint report of the Canadian Pulp and Paper Association and the Forest Pest Management Institute

## technical reference

### herbicide

# HEXAZINONE

#### ▶ BASIC FACTS

##### 1. Common Name

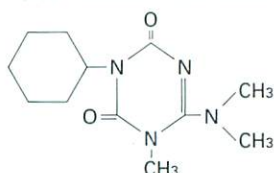
Hexazinone

##### 2. Chemical Classification

Triazine herbicide

##### 3. Chemical Name and Structural Formula

3 - cyclohexyl -6- dimethylamino -1- methyl - 1H - 1,3,5 - triazine - 2,4 - dione



##### 4. Commercial Products

- 4.1 Name:** Velpar® L Weed and Brush Killer  
**Manufacturer:** E.I. DuPont de Nemours & Co. (Inc.)  
**Reg. No. under Pest Control Product Act:** 18197  
**Guarantee:** Hexazinone 240 g/L (25%)  
**Additive:** Alcohol Base Carrier (75%)
- 4.2 Names:** a) Clean Crop® Pronone® 5G  
 b) Clean Crop® Pronone® 10G  
**Manufacturer (technical):** E.I. DuPont de Nemours & Co. (Inc.)  
**Manufacturer (formulation):** Pro-Serve Inc.  
**Distributor:** United Agri Products  
**Reg. Nos under Pest Control Product Act:**  
 a) 21389 - b) 21390  
**Guarantees:** Hexazinone by weight, a) 5% - b) 10%  
**Additive:** Clay

##### 5. Physical and Chemical Properties

- 5.1 Velpar® L**  
**Appearance:** Clear, light yellow liquid.  
**Odour:** Odourless to slight alcohol odour.  
**Volatility:** Volatilization losses are negligible.  
**Viscosity:** In concentrated form, relatively viscous.  
**Stability:** Stable for at least 2 years under normal warehouse storage. Stable up to 37°C; crystallizes at 1°C. Reverts to liquid solution upon thawing.  
**Corrosivity:** Non-corrosive.  
**Reactivity:** Avoid contact with strong acids or bases.

**Flammability:** Flammable in concentrated form but non-flammable when mixed with water.

##### 5.2 Clean Crop® Pronone® 5G and Clean Crop® Pronone® 10G

**Appearance:** Dry, free flowing granule (3-5 mm diameter).  
**Odour:** Odourless.  
**Volatility:** Non-volatile.  
**Flammability:** Non-flammable.  
**Corrosivity:** Non-corrosive for equipment.

##### 6. History

Hexazinone was first developed in 1968. Velpar®, in its powder form, was first registered in Canada in 1975 for industrial weed control. Velpar® L, the liquid form, received a temporary Canadian registration for woodlands management use in 1984, a full registration in 1990, and an expansion for aerial application in 1991. The granular forms, Clean Crop® Pronone® 5G and Clean Crop® Pronone® 10G, were registered in 1991.

##### 7. Herbicide Spectrum and Mode of Action

Hexazinone formulated products are used in the control of annual, biennial and perennial weeds and grasses and woody plants. Velpar® L is a water dispersible solution to be mixed in water. Clean Crop® Pronone® is a granular product that contains water soluble hexazinone which is readily moved from the granules into the soil by rainfall. Hexazinone is readily absorbed through the roots. The translocation is primarily upward through the xylem. Although the mode of action has not been clearly established, it appears to be a photosynthetic inhibitor. (WSSA, 1983). It provides both residual and contact control.

#### ▶ REGISTERED USES AND APPLICATION TECHNOLOGY

##### 1. Registered Uses for Forestry

Velpar® L is registered for the control of certain weeds in Christmas tree plantations and for woodland management (< 500 ha), by broadcast application and undiluted spot treatment for site preparation and conifer release. Aerial applications are restricted to woodland management for site preparation. Clean Crop® Pronone® 5G and 10G are registered for site preparation by ground applications in woodland management.

## 2. Operational Details

Potential users are referred to the official labels, local and/or provincial laws and regulations, federal and provincial forestry regulatory officials and manufacturer's literature for the details necessary to plan specific projects. It is recommended that when used the first time, it should be applied on small areas because Velpar® L and Clean Crop®Pronone®'s effects on conifers vary with the soil type, uniformity of application and environmental conditions.

Water bodies are to be avoided by respecting buffer zones of 50 metres during ground applications and 100 metres during aerial applications.

Do not use Velpar® L or Clean Crop®Pronone® on gravelly or rocky soils, or soils which are sandy or coarse textured. Do not apply to sites where the product cannot penetrate the roots of the target species, such as frozen and snow covered soils and water saturated sites. Do not use on sloped sites with high run-off potential. Avoid treating sites that may be subject to erosion following improved weed control.

**Site preparation:** Broadcast applications with Velpar®, by ground or air, are made in the spring after the ground has thawed. Do not plant immediately after application if you use a rate higher than 9 L/ha. For broadcast applications with Clean Crop®Pronone®, uniform distribution on soil with ground equipment is recommended. If application rates are above 40 Kg/ha (Pronone®5g) or 20 Kg/ha (Pronone®10G), wait one season before planting spruces and red pine. These products control goldenrod, brome grass, raspberries and blue joint grass.

**Conifer release:** Use Velpar® L for undiluted spot treatment with a handgun applicator for control of aspen, ash, maple, cherry and birch in balsam fir, black spruce, white spruce and red pine plantations. To avoid damage to desirable conifers, it is important to spray as close as possible to the root collar of the plants to be controlled, and at least 1 m from the conifers. For best results, several scattered light applications (spots) are recommended rather than a single, heavy one.

### Recommended Use Rates

#### ■ Clean Crop® Pronone®:

Use Clean Crop® Pronone® 5G at rates of 40 to 80 Kg/ha and Clean Crop® Pronone® 10G at rates of 20 to 40 Kg/ha. These products are ready to use and require no mixing. Apply in spring after danger of frost has passed, before or during the period of active growth, when rainfall can be expected to activate the chemical in the soil.

#### ■ Velpar® L:

As a general guide, the following summary should be adequate for basic decision making and budgeting. They are general target, rates and seasons. Local rates may vary depending a variety of factors such as size and density of the weeds, and texture and content of organic material in the soil.

Registered Use	Targets	Rate	Timing (Velpar® L)
Site preparation in Christmas trees and areas of woodland management.	annual, biennial and perennial weeds	9.0 - 18.0 L/ha 2.16 - 4.32 kg a.i./ha <sup>1</sup>	In spring just before or soon after weed emergence, until late July.
Spot treatment conifer release in balsam fir, black spruce, white spruce and red pine plantations.	Brush/trees	0.75 - 1.5 ml /cm dbh	In spring after soil has thawed or early summer. Treatments after end of July are not effective.
Broadcast treatments for conifer release in Christmas tree and conifer plantations	weeds/shrubs	2.1 - 8.3 L/ha (max 6.3 L/ha for white spruce)	In the spring before weeds have more than 5 cm of new growth.

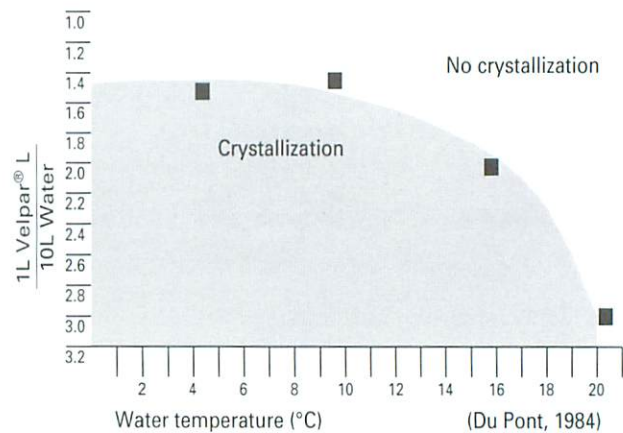
<sup>1</sup> a.i.: active ingredient

## EQUIPMENT MIXES (VELPAR® L)

### -Broadcast Application

When preparing solution for broadcast application, fill the spray tank with half the amount of water to be used. Add the proper amount of Velpar® L, mix thoroughly and add the remaining amount of water. A defoamer may be used to avoid foaming. Use at least 5 litres of water for each litre of product. Because the solubility of Velpar® L in water varies with the temperature of the water, adjust the amount of the product to the amount of water as determined by the water temperature (see figure). At low temperature the carrier will crystallize. If you have crystallization, the carrier will return into the solution after it warms up. Use the solution immediately after mixing. Do not store.

### WATER RATIOS AS A FUNCTION OF WATER TEMPERATURE



### -Spot treatment

For spot treatment no mixing is necessary. Use the undiluted product with an exact delivery spotgun applicator.

## EFFECTS ON BIOTA

### 1. Plants Controlled

Velpar® L is effective against a wide variety of annual, biannual and perennial weeds as well as woody plants.

The degree of control and duration of effect will vary with the amount of chemical applied, rainfall, temperature, weed and brush species, soil moisture and other conditions.

For herbaceous vegetation, under warm and humid conditions, weeds will die within 2 weeks after application. If weather is cool, symptoms will probably occur in 4 to 6 weeks. Treatment is more effective when soil moisture is present at the time of spraying and when at least 1 cm of rainfall occurs within 2 weeks of application.

For brush and trees, symptoms usually appear within 3 weeks after sufficient rainfall has carried the product into the root zone when the tree is actively growing.

Plants are not equally susceptible to hexazinone and its formulated products. Tolerant plant species are able to metabolize doses of herbicide which susceptible species cannot. This selectivity feature allows the maintenance of compatible wildlife browse and cover species while controlling those species which retard conifer growth.

## Guide to Velpar® L Selectivity

Species	Tolerance	No. of kgs a.i./ha for release on a medium textured soil
Raspberry, blackberry (Rubus spp.)	Susceptible	
Grasses (Graminaea spp.)	Susceptible	
Sedges (Carex spp.)	Susceptible	
Cedar (Thuja spp.)	Susceptible	
Larch (Larix spp.)	Susceptible	
Asters, Thistles, Goldenrod (Compositae Family)	Susceptible	
Jack Pine	Susceptible	
White Pine	Intermediate	
Maple (Acer spp.)	Intermediate	
Willow (Salix spp.)	Intermediate	
Balsam poplar	Intermediate	
Birch (Betula spp.)	Intermediate	
Trembling Aspen	Intermediate	
Hazel	Int./tolerant	
Fireweed	Int./tolerant	
Spruce	Int./tolerant	
Alder (Alnus spp.)	Tolerant	
Bunchberry	Tolerant	
Balsam Fir	Tolerant	
Dogwood	Tolerant	
Blueberry (Vaccinium spp.)	Very tolerant	
Scotch Pine	Very tolerant	
Red Pine	Very tolerant	

(Source: DuPont Canada Inc.)

## 2. Effects on Non-Targets

Available data on toxicological properties of hexazinone show that this herbicide has a low toxicity to most organisms tested (USDA, 1984). In fact, the acute toxicity of Velpar® L is less than that of aspirin.

### Water and soil

#### -Water (Hex)<sup>2</sup>

Hexazinone degrades readily via photodegradation (Rhodes, 1980) however, recent studies suggest that degradation of hexazinone in aquatic systems may be inhibited under cool and/or light-limited conditions (Thompson *et al.* 1992).

#### -Soil (Hex)

Hexazinone dissipates by photodegradation and biodegradation to various metabolites and by leaching. It does not persist in soil for a long period of time, half-life is 1 to 6 months depending on the site. No detrimental effects on the soil nitrification process occur at doses of 5 and 20 ppm.

### Micro-organisms

#### -Soil micro-organisms (Hex)

No changes in community compositions occur after application.

#### -Aquatic invertebrate (Hex)

Although practically non-toxic to aquatic invertebrates and insects in laboratory tests (Kreutzweiser *et al.*, 1992), recent studies have shown that prolonged exposure to hexazinone may result in direct adverse effects on phytoplankton and resultant indirect effects on zooplankton communities (Thompson *et al.*, 1993a&b).

#### -Daphnia Magna (Hex)

48 hrs. LC<sub>50</sub><sup>3</sup> = 151 ppm (USDA, 1984)

### Terrestrial Invertebrates

#### -Honey Bees

Relatively non-toxic (48 hrs. LC<sub>50</sub> = 96 hrs. LC<sub>50</sub> = 995 ppm > 60 µg/bee)

### Fish

Practically non-toxic to warm-water and cold-water fish (Thompson *et al.*, 1993c).

-Bluegill (Velpar® L) 96 hrs. LC<sub>50</sub> = 995 ppm

-Rainbow Trout (Hex) 320 ppm < 96 hrs. LC<sub>50</sub> = 420 ppm

-Bluegill (Hex) 96 hrs. LC<sub>50</sub> = 505 ppm

-Fathead Minnow (Hex) 96 hrs. LC<sub>50</sub> = 274 ppm

<sup>2</sup> Hex = Hexazinone

<sup>3</sup> LC<sub>50</sub> - Lethal concentration in air or water which kills 50% of the individuals.

## Birds

Hexazinone is relatively non-toxic to birds.

-Mallard Duck 8 days LC<sub>50</sub> > 10,000 ppm

-Bobwhite Quail Acute oral LD<sub>50</sub><sup>4</sup> = 2258 mg/kg  
8 days LC<sub>50</sub> > 10,000 ppm

## Mammals

Studies with rodents indicate that hexazinone is non-carcinogenic, non-teratogenic and has little or no effect on fertility, reproduction or development. (USDA, 1984)

**NOTE:** Strict adherence to label restrictions and recommended use rates is required to reduce potential adverse effects on water quality or aquatic ecosystems.

## ▶ SAFETY

### 1. Handling

Hexazinone is relatively low in toxicity and its application presents little if any danger to wildlife, fish, soil or watershed when used as directed. As with any chemical, it is prudent to take precautions to minimize exposure, especially contact of the undiluted product with the eyes. Velpar® L is classified as a severe eye irritant but not considered a skin irritant.

- Wear goggles or face shield and rubber gloves
- Remove and wash contaminated clothing before re-use.
- Do not get in eyes.
- Avoid contact with the skin or clothes.
- Avoid breathing spray mist. Respiratory protection is not necessary if rules governing sprays are observed, i.e., not spraying in windy conditions or being exposed to spray from other operators.

### 2. Product Precaution

- Avoid contamination of fertilizer, insecticides, fungicides and seeds.
- Prevent drift to desirable plants.
- Do not contaminate any body of water.
- Keep away from heat, sparks and open flame.
- Do not apply, drain or flush equipment on or near desirable trees.

### 3. Disposal and Storage

- Store in original container only.
- Store Clean Crop®Pronone® in a cool dry area.
- Clean equipment and empty containers by rinsing with clear water and bury the rinsings in a non-crop, non-grazed area away from water supplies according to government disposal regulations.
- Do not re-use containers: destroy them when empty, bury them with rinsings or deliver to a sanitary landfill dump according to government disposal regulations.
- Spills or leaks: clean up promptly. Absorb liquid spills with earth or sand and pick up by the most effective means. If spill area is on the ground near trees or other valuable plants, remove the top 8 cm of soil after initial cleanup. If in doubt as to removal, spread activated charcoal evenly at a rate of .034 kg/m<sup>2</sup> and incorporate lightly.

### 4. Medical Treatment

#### FIRST AID

In case of contact, flush skin and eyes with plenty of water, for at least 15 minutes; in the event of contact with eyes, get prompt medical attention. In case of ingestion, administer water freely and induce vomiting. Repeat until fluid is clear.

For medical emergency, call DuPont, Wilmington, Delaware 1-800-441-3637.

<sup>4</sup> LD<sub>50</sub> - Lethal dose which kills 50% of the individuals, could be absorbed orally, dermally or by inhalation.

## ► QUESTIONS AND ANSWERS

### Q. Does Hexazinone bioaccumulate in animals ?

A. Ingested hexazinone is rapidly excreted in urine and eliminated in faeces. It does not bioaccumulate appreciably in animals, and tissue residues of both Hexazinone and its metabolites, decrease rapidly when exposure to Hexazinone ceases. (USDA, 1984)

### Q. Because Velpar® L is a residual herbicide absorbed by the roots, how long do we have to wait to plant trees after site preparation ?

A. It appears that in the soil, hexazinone is dissipated by photodegradation and biodegradation to various metabolites and by leaching. Field studies have shown that if the rate of application is 9.0 l/ha or less, black spruce, white spruce and red pine may be planted immediately after application. If the rate is higher, you do not plant until one season after application.

## ► REFERENCES

### 1. Addresses of Manufacturers

#### Hexazinone and Velpar® L

DuPont Canada Inc.  
General Products Division  
P.O. Box 2300, Strettsville  
Mississauga, Ontario  
L5M 2J4  
Tel: (416) 821-5586  
Fax: (416) 821-5505

#### Clean Crop® Pronone® 5G and Clean Crop® Pronone® 10G

Manufacturer  
Pro-Serve Inc.  
400 E. Brooks R.  
Memphis, TN USA 38116  
Tel: (901) 332-7052

Distributor  
United Agri-Products  
R.R no 2  
Dorchester, Ontario  
N0L 1G5  
Tel: (519) 268-8001  
Fax: (519) 268-8013

### 2. References in the text

**DuPont**, 1984. Velpar® Herbicide for Faster growing Conifers. 10 p.

**Rhodes, R.C.**, 1980. Studies with 14C-labeled hexazinone in water and bluegill sunfish. *J. Agriculture and Food chemistry*. 28: 306-310.

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