Public Health Ontario | Santé publique Ontario

PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

Scientific and technical advice

Use of ClearView Herbicide in Wild Parsnip and Giant Hog Weed Control

Requestor: E. Jane Lyster, Director Community Health Protection Department
Leeds, Grenville & Lanark District Health Unit

Request prepared by: Nicole Somers, MPH, Environmental Health Analyst
John G. Minnery, PhD, MPH, P.Eng, Manager (Acting), Toxicology & Exposure Assessment

Date: 19-Jun-15

Contact information: nicole.somers@oahpp.ca

The following has been prepared at the request of the Leeds, Grenville & Lanark District Health Unit to assist with the addressing public concerns about the use of the herbicide ClearView to control invasive poisonous plant species such as wild parsnip and giant hogweed in road side ditches and rights-of-way located within Lanark County.

METHODS

Databases including Pubmed, Environment Complete, Scopus and Google Scholar were searched with a combination of the terms ClearView, aminopyralid, metsulfuron methyl, wild parsnip, giant hog weed, herbicide, and health effects. In addition, a number of grey literature resources were reviewed including the EFSA, USEPA, OMAFRA and Health Canada's PMRA. Relevant references were reviewed.

HEALTH CONCERNS RELATED TO TARGET PLANT SPECIES

The invasive plant species that are the main target of the ClearView spraying in Lanark County include two main invasive poisonous plant species, wild parsnip and giant hogweed. Due to their high dermal toxicity, manual removal of these plants from roadsides and rights-of-way has proven to be hazardous to workers, leading to the use of ClearView herbicide as the proposed alternative to population control.

Ontario
Agency for Health Protection and Promotion
Agence de protection et de promotion de la santé

Wild parsnip (*Pastinaca sativa*)

Wild parsnip is a perennial invasive poisonous plant species (will return year after year) that reproduces by seed, the majority of which germinates in the spring.

Health Effects

The sap from wild parsnip contains phototoxic furocoumarins, which have the potential to cause photodermatitis (irritation of the skin upon exposure to sunlight) in some individuals. Exposure to various parts of the plant, including leaves, stems, and peeling roots can be a source of the toxic sap. [1]

Although parsnip roots are considered edible, they contain enough furocoumarins to cause a physiological response. Consumption of 0.1 kg of wild parsnip root could expose an individual to 4-5 mg of psoralen (a type of furocoumarin), a level which may cause physiological effects. The toxins from wild parsnip are also known to be mutagenic, inducing melanisation in human skin. [1]

Giant hogweed (*Heracleum mantegazzianum*)

Giant hogweed, also known as Giant cow parsnip, is a perennial invasive poisonous plant species (will return year after year). Giant hogweed can look similar to other non-poisonous plant species such as Queen Annes's-Lace, with its white clusters of flowers atop tall green stalks. Giant hogweed can be distinguished from other species based on its characteristically large size, growing to heights of up to 5.5 meters tall with flower heads up to 1 meter wide. [2]

New plants can only be established through seed. Individual plants are only able to seed once per lifetime, after which the original plant will die. Giant hogweed spreads easily, and has been known to invade sites such as roadsides, ditches, streams, old fields and native woodlands. Each plant is capable of producing up to 120,000 seeds which can spread by traveling via waterways in ditches, streams and rivers as well as via wind. These seeds can be viable in soil for up to 15 years. The best strategy for limiting the growth and spread of giant hogweed is to stop the spread of seed. [2]

Health Effects

The sap from giant hogweed contains furocoumarins (psoralens), which are known to cause phytophotodermatitis, a type of plant induced dermatitis that makes the skin hypersensitive to UV light. The sap of giant hogweed is extremely phototoxic, resulting in rashes, blisters, itchy swelling skin and long-lasting scars. In addition, if the sap comes into contact with the eyes it has been known to cause blindness. In order to effectively kill giant hogweed, the plant must be pulled out by the root, which can be highly hazardous to staff performing this duty. [2]

In addition, giant hogweed can reach sizes of up to 18 feet, causing dangerous blind spots for drivers where it is allowed to grow unchecked.

ENVIRONMENTAL TOXICOLOGY AND HEALTH EFFECTS OF CLEARVIEW

Many commercially available pesticides, including ClearView, are made up of a mixture of both active and inactive ingredients. Active ingredients are the chemicals that are meant to repel or kill the target pest, while inactive ingredients such as water or isopropanol are generally non-toxic and are mainly used as stabilizers, solvents or to assist in the application process. The overall toxicity of ClearView as well as specifics on active and certain inactive ingredients in the product will be discussed below.

Properties of ClearView

ClearView is an herbicide produced by Dow AgroSciences and comes in the form of a brown granule with a mild odour. It is registered in Canada by Health Canada's Pesticide Management Regulatory Agency (PMRA) under the *Pest Control Products Act* for the control of broadleaved weeds and woody plants in roadside, rights-of-way and other non-crop use areas. [3]

Exposure Profile

Residents in Lanark County may be exposed to ClearView through spray drift (inhalation), dermal contact and ingestion of contaminated drinking water. Local residents have been given the option of opting out of having their properties sprayed, which will reduce exposure in cases where residents are concerned about the potential exposures listed above.

Toxicity

ClearView is absorbed by plant leaves and roots, and is then translocated throughout the plant causing it to die. It is intended for use on non-crop growing areas as legume growth can be affected for 60 months or more post-application. ClearView has a very low acute and chronic toxicity to most non-plant based species and does not tend to bio-accumulate in the environment. Cattle and wildlife do not metabolize ClearView resulting in there being no grazing restrictions on the product. When ingested, it is also rapidly excreted from the body in urine meaning that it does not readily bioaccumulate.

The two main active ingredients in ClearView are aminopyralid potassium and metsulfuron-methyl. The mechanisms of action for these two herbicides are the inhibition of a plant growth hormone and obstruction of cellular division in roots and shoots respectively. These two pathways are specific to plants, as a result ClearView has a low toxicity to species such as humans, animals and water fleas. Based on this, it is expected that the use of ClearView would not pose a risk to the pollinator population in the area being sprayed.

Aminopyralid Potassium

The main active ingredient in ClearView is aminopyralid potassium, which is present at approximately 62% of the formulation per the MSDS. Aminopyralid is a selective systemic pyridine carboxylic acid herbicide that acts on target plant species by mimicking auxin, a natural growth inhibiting hormone in plants. [4,5] Application results in the disruption of metabolic pathways leading to inhibited plant growth. It is usually used in the control of broadleaf weeds including noxious or invasive species.[4]

Exposure and Fate in the Environment

Aminopyralid is classified as non-persistent to slightly persistent in most soils with a half-life ranging from 6-533 days, with a typical length of 103 days. [3,4] Half-life is dependent on factors such microbes or sunlight that can cause more rapid breakdown in the environment. Additionally, factors such as cold temperatures and snow cover can increase this time. [4] It does not tend to bioaccumulate in the environment or bioconcentrate up the food chain. [3,4]

Aminopyralid has moderate mobility in the environment and has been known to travel from soil to water. [3] Where it does move through the soil, leaching to groundwater is expected to be mitigated due to interception by groundcover and rapid biotransformation in the soil. [3] Aminopyralid is highly soluble in water, and the potential for groundwater leaching under Canadian use conditions was assessed using modelling. The highest Aminopyralid level detected in Canadian groundwater is 1.8 ug/L leading to the conclusion that despite being moderately mobile, it poses a negligible risk to both wildlife and humans.[3,4] Aminopyralid is not expected to volatilize under field conditions based on vapour pressure making inhalation an unlikely route of exposure when used according to label directions.[3]

Health Effects

Pyridine herbicides such as aminopyralid are considered low toxicity herbicides with limited reports of human poisoning data. Aminopyralid is not readily metabolized. Approximately 74-100% of orally administered aminopyralid is excreted from the body through urine and feces within 24 hours mostly unchanged, indicating low potential for bioaccumulation. [4,5]

In acute exposure scenarios aminopyralid has a very low toxicity if individuals accidentally eat, touch, or inhale residues. Chronic doses have been linked to effects such as decreased body weight and inflamed mucous membranes when fed to rats. Toxicity tests have shown that exposures of greater than 5,000 mg/kg (i.e. greater than 350,000 mg for an average adult) can be ingested or absorbed dermally before adverse health effects would begin to occur. In animal tests, aminopyralid was not found to cause skin sensitization or reproductive effects; however it was linked to eye irritation when used alone. Additionally, it has been found to be practically non-toxic to species such as mammals, birds, fish and aquatic insects. [4,5]

Reviews on carcinogenicity potential have ranked aminopyralid as presenting a negligible cancer risk under expected average exposure scenarios. [4] The US EPA has classified aminopyralid as “Not Likely to Be Carcinogenic to Humans”. [4,6]

Health Canada Regulation

The PMRA has assessed whether exposure to aminopyralid through Canadian groundwater used as a drinking water source presents an unacceptable risk. The PMRA found that aminopyralid had a low acute toxicity and no acute reference dose was identified. Chronic dietary exposure from food and drinking water constitutes 0.3-1.0% of the acceptable daily intake of 0.5 mg/kg bw/day for all population subgroups and is below the level of concern. Based on this assessment, the PMRA has concluded that there are no acute or chronic risks for concern from groundwater under the current conditions of use. [3]

Metsulfuron-methyl

Metsulfuron-methyl is present in ClearView at a concentration of approximately 9.5% per the MSDS. Metsulfuron-methyl acts on target plant species by stopping cell division in the roots and shoots of plants, causing them to die. [7] This mode of action is specific to plants, resulting in metsulfuron-methyl having low toxicity to humans and animals.[8] Although it is taken up and moves throughout the plant rapidly, effects no not tend to be long lasting. [7] It is typically used to control weeds and other broadleaf plants both before and after growth begins. [7,8]

Exposure and Fate in the Environment

Metsulfuron-methyl is classified as non-persistent in soil with a half-life ranging from 14-180 days, with a typical length of 30 days. It is stable in sunlight, but breaks down faster in moist, warm soil. Additionally, factors such as cold temperatures and snow cover can increase this time [7,8] It is also relatively stable in water, with a half-life of approximately 3 weeks. [8]

Metsufuron-methyl is highly mobile in the environment, traveling easily from soil to groundwater. [7] It has also been found to enter surface water via runoff. Metsulfuron-methyl is biologically active at low concentrations, with small amounts of spray drift being responsible or significant damage to adjacent plants and trees, however it poses a negligible risk to both wildlife and humans.[8] Volatilization is not expected to play an important role due to its low vapour pressure. [9]

Health Effects

Metsufuron-methyl is considered a low toxicity herbicide by the US EPA with exposures being uncommon, generally occurring in agricultural settings. Metsufuron-methyl is broken down quickly and rapidly eliminated from the body. Approximately 71-95% of orally administered metsufuron-methyl is excreted from the body through urine within 9-29 hours depending on the dose, indicating low potential for bioaccumulation. [7,9]

In acute exposure scenarios metsufuron-methyl has a low to very low toxicity if individuals accidentally eat, touch, or inhale residues. Toxic effects seen in animals are unlikely to occur after short-term, low-level exposures in humans. [7,8] Severe toxicity has only been reported in humans after deliberate ingestion. [9] Chronic doses have been linked to weight changes due to decreased appetite. [7] Toxicity tests have shown that an average adult can ingest 17.5 mg/day over a lifetime without appreciable risk.[8] In animal tests, metsufuron-methyl did not cause nerve damage or affect reproduction; however it was correlated with lower growth rates and offspring deaths when ingested at high doses. [7,8] It was also linked to moderate skin irritation and was found to be very irritating to the eye, although not corrosive. [7-9] Additionally, it has been found to be practically non-toxic to species such as mammals, birds, fish and aquatic insects. [7,8]

Reviews on carcinogenicity potential have ranked metsulfuron-methyl as presenting a negligible cancer risk under expected average exposure scenarios. [7] The US EPA has classified metsulfuron-methyl as “Not Likely to Be Carcinogenic to Humans”. [6,7,9]

Although the expected exposure associated with metsulfuron-methyl sprayed in ditches or rights of way is not expected to result in adverse human health effects, it is recommended that individuals do not walk through freshly sprayed vegetation in addition to avoiding ingestion of food or water in newly sprayed areas. [8]

Non-active ingredients

The MSDS for ClearView also lists the inactive ingredient titanium dioxide at a concentration of 0.1% of the formulation. Although titanium dioxide is considered to be a carcinogen, this is only true in inhalation studies where it causes lung fibrosis and tumors in rats. Due to the low levels present in the product, along with the likely routes of exposure, titanium dioxide is not expected to cause an adverse health effect in this scenario.

SUMMARY

Lanark County intends to use the herbicide ClearView to control invasive toxic plants such as Wild parsnip and Giant hogweed in road side ditches and rights-of-way. The plants in question are highly toxic causing photophytodermatitis and even blindness in some cases. Due to their toxicity, these plants represent a hazard to the community if they are not removed.

The mode of action through which ClearView acts is specific to plants, resulting in low toxicity to non-target species. Due to this, the use of ClearView herbicide to control these toxic plant species does not appear to pose a significant risk to human, animal or insect (pollinator) health.

REFERENCES

(1) Integrated Taxonomic Information System (ITIS): Species Bank, Canadian Poisonous Plants Information System. Wild Parsnip. [Canadian Biodiversity Information Facility]. March 4, 2014. Available at: http://www.cbif.gc.ca/eng/species-bank/canadian-poisonous-plants-information-system/all-plants-common-name/wild-parsnip/?id=1370403267249. Accessed June 11, 2015.

(2) Integrated Taxonomic Information System (ITIS): Species Bank, Canadian Poisonous Plants Information System. Giant Hogweed. [Canadian Biodiversity Information Facility]. November 4, 2014. Available at: http://www.cbif.gc.ca/eng/species-bank/canadian-poisonous-plants-information-system/all-plants-common-name/giant-hogweed/?id=1370403267119 . Accessed June 11, 2015.

(3) Pest Management Regulatory Agency (PMRA). Special Review of Aminopyralid: Proposed Decision for Consultation. [Health Canada]. April 24, 2014. Available at: http://www.hc-sc.gc.ca/cps-spc/alt_formats/pdf/pest/part/consultations/_rev2014-01/rev2014-01-eng.pdf. Accessed May 21, 2015.

(4) Washington State Department of Transportation. Aminopyralid - Roadside Vegetation management Herbicide Fact Sheet. [WSDOT]. 2015. Available at: http://www.wsdot.wa.gov/NR/rdonlyres/CD6D91AC-D382-4E5D-AF1E-50C52C34484F/0/Aminopyralid.pdf.

(5) TOXNET: Toxicology Data Network, Hazardous Substances Data Bank (HSDB). Aminopyralid. [U S National Library of Medicine]. June 1, 2012. Available at: http://toxnet.nlm.nih.gov/cgi-bin/sis/search2/f?./temp/~zLUtKH:1. Accessed June 16, 2015.

(6) Office of Pesticide Programs, United States Environmental Protection Agency. Chemicals Evaluated for Carcinogenic Potential. [US EPA]. February 10, 2014. Available at: http://npic.orst.edu/chemicals_evaluated.pdf.

(7) Washington State Department of Transportation. Metsulfuron-methyl - Roadside Vegetation management Herbicide Fact Sheet. [WSDOT]. January 2, 2006. Available at: http://www.wsdot.wa.gov/NR/rdonlyres/2A7ABA10-EDC5-481A-88BD-B9C559DB7449/0/Metsulfuron.pdf.

(8) Extension Service, Department of Agricultural Chemistry, Environmental Toxicology & Chemistry Program, Oregon State University. Metsulfuron-methyl - Pesticide Fact Sheet: Forestry Use. [NIEHS]. January 11, 2002. Available at: http://www.oregon.gov/odf/privateforests/docs/metsulfuronmethyl.pdf.

(9) TOXNET: Toxicology Data Network, Hazardous Substances Data Bank (HSDB). Metsulfuron-methyl. [U S National Library of Medicine]. June 1, 2012. Available at: http://toxnet.nlm.nih.gov/cgi-bin/sis/search2. Accessed June 16, 2015.