



technical reference

insecticide

FENITROTHION

► BASIC FACTS

1. Common Name:

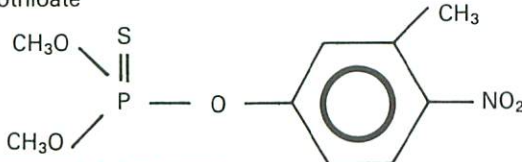
Fenitrothion

2. Chemical Classification:

Organophosphorous insecticide

3. Chemical name and structural formula:

0,0 - dimethyl - 0 - (4 - nitro - m-tolyl) phosphorothioate



4. Commercial Product:

Name	Manufacturer	Reg. No. under the Pest Control Products Act	Guarantee (g. a.i. ⁽¹⁾ /L)
Novathion®	Cheminova	14299	1,257
Folithion®	Chemagro	10776	1,260
Sumithion®	Sumitomo	11137	1,250

5. Physical and chemical properties

(Technical Fenitrothion)

Appearance: Oily liquid, brownish.

Odour: Slight and characteristic.

Viscosity: 20.81 g/cm/sec. at 30°C.

Stability: Stable for 2 years under normal storage conditions.

Purity: In Technical Fenitrothion, the a.i. ≥ 95%, remainder consists of impurities formed during manufacture and storage.

Solubility: Low in distilled water, 20 to 30 ppm. Soluble in alcohols, ethers, ketones and aromatic hydrocarbons. Slightly soluble in aliphatic hydrocarbons.

⁽¹⁾ a.i. active ingredient

® Registered trademark

6. History

Fenitrothion was first reported in 1956 by Drabek and Pelikan. In Canada, its main application is the control of spruce budworm. It has been used extensively since 1969 as a replacement for DDT.

7. Insecticide Spectrum and Mode of Action

Fenitrothion is a broad spectrum insecticide used extensively throughout the world for the control of agricultural and forest pests.

Like all the organophosphorus insecticides, it is a cholinesterase inhibitor and affects acetylcholinesterase functions in the nerve junctions with muscles. It is absorbed effectively through skin and stomach.

(Cholinesterase is an enzyme which is essential to the proper working of the nervous system.)

► REGISTERED USES AND APPLICATION TECHNOLOGY

1. Registered uses for Forestry

Fenitrothion has a restricted registration for the control of the larval stages of spruce budworm, eastern hemlock looper, western hemlock looper, sawflies, cankerworm, jackpine budworm and spruce budmoth in forests, woodlots, tree nurseries and Christmas tree plantations following consultation with federal and provincial forestry regulatory officials and in accordance with their directions. This product, registered for forest management use (≥ 500 ha) and woodlands management use (< 500 ha), may be applied by ground or aerial spraying.

2. Operational Details

Potential users are referred to the official label, local/provincial laws and regulations, federal and provincial forestry regulatory officials and manufacturers' literature for the details necessary to plan specific projects. The timing of the application will depend on the stage of development of the insect.

■ Usage Rates

Apply liquid concentrate at the rate of 111 to 222 ml of product (140 to 280 g a.i.) per hectare. Use no more than 222 ml of product (280 g a.i.) per ha for any one application and a total of 333 ml of product (420 g a.i.) per ha per year if applied in two treatments, 4 to 6 days apart.

■ Target and Timing

Target	Timing
Spruce Budworm Spruce Budmoth	Between the 2nd and 4th instars, depending on the bud development.
Hemlock Looper	Before the 4th instar.
Jackpine Budworm	Between the 2nd and 4th instar.
Sawflies and Fall Cankerworms	As soon as the larvae appear.
Swaine Jackpine Sawfly	At the peak of emergence of the 2nd instar.

■ Mixing

Technical Fenitrothion may be mixed only with the following liquids:

Oil

For 280 g a.i. in 1.5 L/ha, the spray mixture should include:

concentrate: 15%

solvent: 45% (Cyclosol 63 or Dowanol TPM)

diluent oil: 40% (585)

Water

For 210 g a.i. in 1.5 L/ha, the spray mixture should include:

concentrate: 11%

solvent: 1.5% (Dowanol TPM)

emulsifier: 1.5% (Atlox 3409F)

water: 86%

NOTE:

The percentages could change with aircraft speed, atomization equipment, exact dosage of active ingredient, and total spray volume desired per hectare. Contact federal or provincial forestry officials for exact mixing recommendations. You can add 1% of colorant for checking methods.

centration was reduced to less than detectable levels or (< 0.005 ppm), depending on the soil. Degradation mechanisms include photo lysis, volatilization, leaching and to micro-organism activity. (MER, 1984a)

■ Micro-Organisms and Plankton

Soil micro-organisms

No major modification expected.

Phytoplankton

High resistance to insecticide.

Zooplankton

Occasional variable decrease in the population.

Cladocera are very sensitive to Fenitrothion.

Daphnia magna

24 hrs. $LC_{50}^{(2)} = 5$ ppm

■ Vegetation

Leaves

No effect.

Seedlings

Possibility of light and temporary effects on the survival percentage and speed of germination of some tree species. Softwood seems to be more resistant than hardwood.

■ Terrestrial invertebrates

Parasites of budworm

Until now, no effect.

Predaceous arthropods

Over the long term predation and parasitism processes do not appear to be affected even with repeated annual treatments. (Kingsbury 1984)

Arthropods in the soil

No important effect one year after treatment.

Pollinators

Variable mortality followed by a recuperation period of 1 to 3 years. Minimal effects on honey products. Possibility of a long-term effect on vegetation because of the decrease in pollinators. (48 hrs. oral $LD_{50}^{(3)} = 0.383$ ug/bee)

■ Aquatic invertebrates

Benthos (lake)

No effect even at high dosage.

Benthos (river)

Some species are sensitive but generally has a small effect on the density of the populations.

■ Fish

Salmonoids

Low toxicity for fish. No direct mortality after treatment. Very small effects expected over the long term.

Rainbow Trout

24 hrs. $LC_{50} = 3.4$ ppm

Atlantic Salmon

24 hrs. $LC_{50} = 1.67$ -1.76 ppm

■ Amphibians

No effect on adult stages. Possibly some effect on eggs and on stages with gills.

■ Birds

No evident effect after application. Over the long term, there is a possibility of sublethal effects on the species living in the tops of trees.

⁽²⁾ LC_{50} — Lethal concentration in air or water which kills 50% of the individuals.

⁽³⁾ LD_{50} — Lethal dose which kills 50% of the individuals, could be absorbed orally, dermally or by inhalation.

► EFFECTS OF BIOTA

1. Insects Controlled

The effects will depend greatly on the dose, the period of application, the habitat and the behaviour of the targets. Usually, under good conditions, Fenitrothion can provide effective control and foliage protection for most of the insects mentioned. (Prebble, 1975)

2. Effects on Non-Targets

(effects at recommended doses)

■ Water and Soil

Water

Fenitrothion concentration decreases rapidly in natural water by volatilization, photolysis, hydrolysis adsorption by sediments and micro-organismes degradation. Half-life = 18 min. to 2 days. (MER, 1984a)

Soil

Experiments have shown that between 21 days and 1 year after a normal application Fenitrothion residue con-

Mallard Duck
3 to 4 months oral LD₅₀ = 1,190 mg/kg

Japanese Quail
7 to 8 weeks oral LD₅₀ = 140 mg/kg

■ Mammals (small)

No direct effect expected on the populations.

(From Étude d'impact du projet de pulvérisations aériennes d'insecticides contre la tordeuse des bourgeons de l'épinette au Québec, 1983-86, MER, version abrégée)

▶ SAFETY

1. Handling

Fenitrothion can be one of the safer insecticides when used correctly (McTaggart-Cowan, 1977). It is safe for applicators and bystanders when used with the recommended safety precautions.

It is necessary to distinguish between the higher order of operator exposure to the concentrated insecticide prior to dilution and spraying, and the much lower exposure of third parties or bystanders to the diluted spray resulting from drift during spraying operations. Although bystanders should be encouraged to avoid direct exposure to the diluted spray mist, accidental exposure to diluted spray material applied under conditions specified on the label will not pose undue risk.

- Wear rubber boots, rubber suit or apron, rubber gloves, respirator, goggles and cap or hat when mixing/processing concentrate.
- Contaminated clothing should be removed and washed before re-use.
- If spilled on the skin, wash immediately with soap and water.
- Wash hands before eating or smoking.
- Keep unauthorized and unprotected persons out of loading or mixing zones.

2. Product Precautions

- Harmful if swallowed, inhaled or absorbed through the skin.
- Avoid contact with eyes or skin.
- Keep away from heat, sparks or open flame because the product is combustible.
- Do not contaminate food or any body of water.

3. Disposal and Storage

- Rinse empty drums thoroughly three times with 25 litres of operational spray diluent oil. Incorporate all the retained rinsings in batches of diluted spray for aerial applications.
- Rinse empty drums with 25 litres of water containing 1 kilogram of caustic soda (lye) and 250 ml of detergent. Bury rinse solution at least 0.5 meter deep in an isolated area away from water supply or according to provincial government disposal regulations.

NOTE

Lye is dangerous to handle. Exercise due care in its use.

- If any area of the exterior of the drum is wet with insecticide concentrate, decontaminate it as described above.
- Decontaminated drums are suitable for commercial reconditioning.
- If drums are destined for disposal sites, puncture them to prevent re-use.

4. Medical Treatment

■ First Aid

In case of poisoning, call a physician immediately. Have patient lie down and keep quiet. If swallowed, administer milk or water freely and induce vomiting by giving one dose (15 ml) of syrup of ipecac. If vomiting does not occur within 30 minutes, administer second dose. If syrup of ipecac is not available, induce vomiting by sticking a finger down the throat. Repeat until vomit fluid is clear. The patient should be lying down with the head below the foot level and facing down or to one side. Professional medical assistance should be secured immediately. Do not induce vomiting to an unconscious person or to persons in convulsive state. If on skin, remove contaminated clothing and wash skin immediately with soap and warm water. If eyes are contaminated, wash immediately with flowing water for at least 15 minutes.

■ Symptoms of poisoning

Headache, weakness, blurred vision, abdominal cramps, tightness in chest, and nausea.

■ Toxicological information (Information for physicians)

This product inhibits cholinesterase resulting in stimulation of the central nervous system. This results in a sense of tightness in the chest, sweating, contracted pupils, stomach pains, vomiting and diarrhea. The antidote is atropine sulfate administered in large therapeutic doses, repeated as necessary to point of tolerance. 2-PAM is also antidotal and may be administered in conjunction with atropine. Do not give morphine. Watch for pulmonary edema which may develop in serious cases of poisoning even after 12 hours. At first sign of pulmonary edema, the patient should be placed in an oxygen tent and treated symptomatically.

▶ QUESTIONS AND ANSWERS

Q. Is it safe to use Fenitrothion?

A. The New Brunswick Task Force on the Environment and Reye's Syndrome (Press Communiqué, 1982) considers that Fenitrothion, the active insecticide used for several years in New Brunswick, is safe in the concentrations now used. One conclusion of the impact study on the spruce budworm spraying program made for MER, Québec, in 1984 is: considering the most sensitive paths, inhalation and oral ingestion, the maximal quantity of Fenitrothion absorbed in the worst case (an adult exposed to the maximum concentration of Fenitrothion in the air resulting from spraying) is 143 times smaller than the unique no-effect dose for humans and 428 times smaller than the daily no-effect dose. (MER, 1984b)

Q. What is the relationship between Reye's Syndrome and Fenitrothion?

A. The data obtained and analyzed by the New Brunswick Task Force on the Environment and Reye's Syndrome has demonstrated that the incidence of Reye's Syndrome was not elevated at any time during the decade of interest. It was actually lower than the incidence of Reye's Syndrome in many widely separated geographic areas of North America where no forest spray programme had been carried out. (Press Communiqué, 1982)

Q. Does forest spraying reduce fish stocks?

A. Broadly speaking, with regard to Fenitrothion the answer is a qualified no. There have been no confirmed reports of substantial fish killed attributable to forest insecticides in the 1970s (Kingsbury, 1976). However, these insecticides at operational rates may sometimes cause temporary reductions in the food supplies of fish (by killing aquatic insects). It is possible that reduced food may lower trout growth rate and biomass during the month following spraying (Symons and Harding, 1974), but there is no evidence that other sublethal effects from spraying would influence the dynamics of gamefish populations.

Q. Do forest insecticides harm the environment?

A. The evidence indicates they cause little overall harm and are short-lived. Fenitrothion particles in the air are rapidly dissipated by wind and broken down by sunlight. Deposits on trees lose most of their potency in a week; only tiny proportions are absorbed through leaf surfaces, and persist for months. Fenitrothion is only faintly toxic to plant tissue, but has no significant effect at conventional dosages. Deposits in animals are rapidly metabolized. Very little of these insecticides penetrate the canopy and ground cover to reach the soil itself (Yule and Duffy, 1972), but scientists know little about their effect on soil biology. However, microbiologists believe that most organophosphorous insecticides at conventional dosages do not harm the bacteria and fungi which are the key elements in nutrient turn-over. Fenitrothion reaching small streams is rapidly diluted and flushed out, generally showing only a small brief peak of concentration (Eidt, 1974). In water, the insecticide itself breaks down to biologically inactive materials within a few days. In all media, the metabolic by-products of Fenitrothion breakdown are mostly non-toxic; the oxygen metabolite, which is toxic, is so unstable as to pose no threat to the biota (Sundaram, 1974).

► REFERENCES

1. Addresses of Manufacturers

Chemagro Limited 1355 Aerowood Drive Mississauga, Ontario Canada L4W 1C2	Sumitomo Canada Ltd. Commerce Centre Postal Station Box 53 Toronto, Ontario Canada M5L 1B9
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Cheminova
Dr — 7620
Lemvig
DENMARK

Canadian Agents:

Davis Chemicals 207 Place Frontenac Suite 5 Pointe Claire, Québec Canada H9R 4Z7	Win Chemicals 1295 Eglinton Avenue East Unit 11 Mississauga, Ontario Canada L4W 3E6
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