Australian
Organic Registered
Farm Input

ALLOWED INPUT 11839

MINERAL SNAIL AND SLUG KILLER WITH ELEMENTAL IRON

The only snail and slug killer that is an Australian Organic Registered Input.
An effective alternative to metaldehyde and methiocarb chemical.

Protect-us™

Mineral

SNAIL AND SLUG KILLER

With Elemental Iron

Protect-us Mineral Snail and Slug Killer is a low-toxic alternative to metaldehyde and methiocarb chemical baits that displays similar, or better, levels of control and protection. *It is the only allowed Registered Input Snail and slug Killer with Australian Organic.*

Australian Organic Registered Input

Active ingredient iron is naturally present in the environment.

Palatability targeted for Australian snail and slug species.

Low risk to people, pets and when applied according to the label can be used in areas where there are dogs, cats, birds, possums and other fauna.

Environment Friendly - Breaks down to natural nutrients for soils and plants.

Snails and slugs are attracted to the Protect-us bait. In fact it actually lures them out of their hiding places.

Pellets designed to ensure they are the right size and consistency for the mollusc's radula (tongue) to scrape the surface and ingest the bait.

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Contains no GMOs (Genetically Modified Organisms).

Mould resistant.

www.protect-us.com.au

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Protect-us Mineral Snail and Slug Killer is a unique, patented product that is highly effective in the control of snails and slugs. When the snails or slugs consume Protect-us, they typically lose their appetite and crawl off to seek shelter and protection where they die. So Protect-us protects all your plants by effectively killing snails and slugs.

FOOD GRADE NUTRIENT

Protect-us Mineral Snail and Slug Killer uniquely uses food grade elemental iron (Fe^0). Elemental iron is an essential dietary nutrient. Any residues present on fruit or vegetables, or systemically available from skin contact, are indistinguishable from iron of environmental origin and consequently it presents a low risk to consumers.

INDEPENDENTLY REVIEWED AND APPROVED GARDEN SAFE

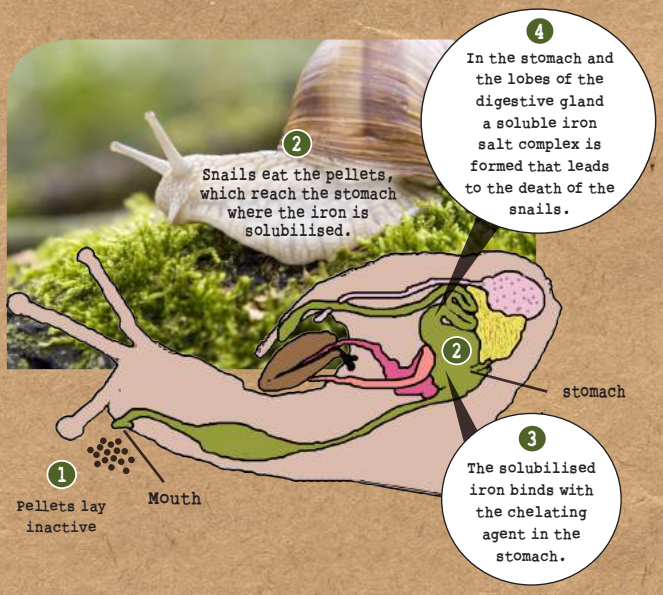
A review of Protect-us Mineral Snail and Slug Killer by the Office of Chemical Safety (OCS) as part of the regulatory process with the Australian Pesticides and Veterinary Medicines Authority (APVMA) summarised, "elemental iron, is of low toxicological concern, and any residues occurring in fruit and vegetables either from absorption of dissolved iron from the soil, or from direct contact would be indistinguishable from environmental iron".

Elemental iron is not included in any Schedule of the *Standard for the Uniform Scheduling of Medicines and Poisons* (SUSMP). The APVMA Review also noted that Protect-us Mineral Snail and Slug Killer was "a product with low to negligible acute oral toxicity." In fact all the ingredients are currently used in either foods for human consumption, pharmaceuticals or cosmetics for human applications.

HOW IT WORKS AND WHY ITS SAFER

Protect-us Mineral Snail and Slug Killer uniquely uses food grade elemental iron (Fe^0) as used in dietary supplements; with a separate, free form, chelating agent that is widely used in human pharmaceuticals and cosmetics.

Each on their own have no effect on snails or slugs. They are kept quite separate in the Protect-us Mineral Snail and Slug Killer bait and do not react with each other, even if the bait pellets are soaked by rain. Only when the bait is eaten by the snails do the two compounds join and activate, resulting in the eventual death of the snails.



Thus it is low-toxic to earthworms, soil micro-organisms, birds, fish, reptiles, and most importantly you and your pets.

The following trial showed how the elemental iron alone, or the chelating agent alone, had no effect on snails or slugs. It was only when both compounds were present together in the snail's alimentary system that mortality occurred.

COMPOUND[5]		
Elemental Iron	Chelating Agent	Mortality of Snails/Slugs
10 g/kg		0%
	40 g/kg	0%
10 g/kg	40 g/kg	100%

BIOACTIVATED BY SNAILS

The low pH gastric digestive fluid inside the snail's alimentary system is required to make the elemental iron soluble. This occurs as the chemical reaction Fe^0 + low pH $\rightarrow Fe^{2+}$.

Only after the iron is solubilised, and the right pH is present, does it bind with the chelating agent. Firmly bound, the *chelated iron* forms a soluble iron salt complex within the stomach and the lobes of the digestive gland.

This iron salt causes the snails and slugs to stop feeding, protecting your plants and leading to the death of the molluscs.

HOW IT KILLS THE SNAILS

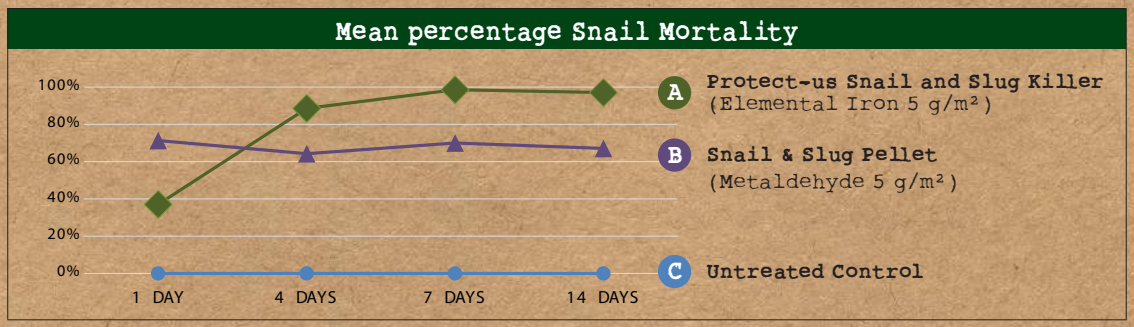
The iron salt in the snail's alimentary system interferes with oxygen uptake by haemocyanin, the respiratory pigment of the snail's haemolymph (blood). This causes the snails and slugs to stop feeding.

This provides a significant benefit over pesticidal active ingredients such as metaldehyde and methiocarb since the level of mortality is independent of prevailing environmental moisture conditions (Henderson et al, 1989[1]).

Protect-us Mineral Snail and Slug Killer also remains stable, since it is only activated once it is inside the snail's digestive system.

SUPERIOR PERFORMANCE

An independent study conducted in NSW showed that Protect-us Mineral Snail and Slug Killer outperformed a leading brand of metaldehyde snail and slug pellets after 4 - 14 days. Protect-us Mineral Snail and Slug Killer was slower to produce initial results in the first couple of days, since it must first be activated in the snail's digestive system.



The consequence of this was that the snails caused significantly less damage to the lettuce leaves in the test plot when Protect-us Mineral Snail and Slug Killer was applied:

Mean percentage of Lettuce Seedling Leaf Area Consumed EFFICACY TRIAL - NSW						
Product	**Active**	**Rate Applied**	**1 DAT**	**4 DAT**	**7 DAT**	**14 DAT**
Untreated Control	None	5 g/m²	0.96%	3.40%	3.70%	16.80%
Protect-us Snail and Slug Killer	Elemental iron	5 g/m²	0.01%	0.20%	0.20%	0.20%
Snail and Slug Pellets	Metaldehyde	5 g/m²	0.04%	0.20%	0.20%	1.40%

* DAT = Days After Treatment

1. *Henderson, I.F., Briggs, G.G., Coward, N.P., Dawson, G.W., Pickett, J.A. 1989. A new group of 459 molluscicidal compounds. 1989 BCPC Mono. No. 41. Slugs and Snails in World Agriculture.*
2. *Edwards, C.A., Arancon, N.Q., Vasko-Bennett, Little, B., Askar, A. The relative toxicity of metaldehyde and iron phosphate-based molluscicides to earthworms. Crop Protection 28 (2009) 289-294.*
3. *Ślimax Bio - Report from Ecotoxicity Studies, IPO Pszczyna, Poland, December 2008.*
4. *Ślimax Bio - Report from Ecotoxicity Studies, IPO Pszczyna, Poland, December 2009.*
5. *Comparison of biochemistry, metabolism and toxicity of different metaldehyde alternatives, ICB Pharma, Unpublished data, 2013.*
6. *Ferronyl® Iron Dietary Iron Supplement for Vitamin, Nutritional, Pharmaceutical and Food Products, ISP (International Specialty Products) Pharmaceuticals brochure, 2005, p. 11*

SAFETY

Protect-us Mineral Snail and Slug Killer has been fully evaluated for safety in a range of tests performed in accord with the requirements of the Organisation for Economic Co-operation and Development (OECD) in a GLP Certified Laboratory.

STUDY[3,4]	METHOD	RESULT
ACUTE TOXICITY		
Acute oral toxicity	OECD No. 420/EU B.1 BIS	LD50 >2000 mg/kg
Acute dermal toxicity	OECD No. 402/EU B.3	LD50 >2000 mg/kg
Acute skin irritation/ corrosion	OECD No. 404/EU B.4	Does not irritate
Acute eye irritation/ corrosion	OECD No. 405/EU B.5	Does not irritate
Skin sensitisation	OECD No. 406/EU B.6	Does not sensitise
EFFECTS ON NON-TARGET SOIL ORGANISMS		
Earthworms, acute toxicity test	OECD No. 207/EU C.8	LC_0 after 14 days >180 mg/kg of soil (dry weight)*
AVIAN TOXICITY		
Avian Acute Oral Toxicity	OECD No. 223	LD50 >2000 mg/kg Japanese quail
EFFECTS ON SOIL MICROORGANISMS		
Nitrogen transformation test	OECD No. 216/EU C.21	No long-term influence on nitrogen transformation in soil
Carbon transformation test	OECD No. 217/EU C.22	No long-term influence on carbon transformation in soil
AQUATIC TOXICOLOGY		
Fish, Acute toxicity	OECD No. 203/EU C.1	LC_{100} @ 96 h >100 mg/L
Daphnia magna, Acute immobilisation	OECD No. 202/EU C.2	EC100 @ 24 h >100 mg/L
Freshwater algae, growth inhibition	OECD No. 201/EU C.3	ErC10 @ 72 h >46.16 mg/L

* There's no official toxicity classification. However, in European Community countries formulations with an LC_{50} > 100 mg/kg dry weight of soil are listed as non-harmful to earthworms. In the case of Protect-us, even the LC_0 is over 100 mg/kg dry weight of artificial soil, therefore it can be classified as a non-harmful product to earthworms.

PROTECT-US MINERAL SNAIL AND SLUG KILLER COMPARED TO IRON EDTA SNAIL BAITS

There are baits containing iron EDTA complexes in the market. These contain 60 g/kg Iron EDTA Complex. Iron EDTA products are very different to Protect-us Mineral Snail and Slug Killer. Protect-us Mineral Snail and Slug Killer uniquely uses elemental iron, with a separate chelating agent. So it is chemically very different which is why Protect-us Mineral Snail and Slug Killer provides great efficacy against snails and slugs, together with a much improved safety profile.

This is why Protect-us have the only snail and slug killer that is a Registered Allowed Input with **Australian Organic**. In fact a detailed study by researchers (Edwards et al, 2009) from the Soil Ecology Laboratory of The Ohio State University and the University of Hawaii advised that molluscicides containing iron EDTA may present significant environmental hazards to earthworms, domestic animals and humans and that these issues needed further investigation. They concluded by stating that the registration statuses of these chemicals in the USA and Europe should be reviewed in light of these new data and conclusions[2].

	Protect-us	Iron EDTA [5]
Constituent	Fe (free) Chelating Agent (free)	$Na^2Fe(III)EDTA$ likely: $Fe(III)(OH)\ EDTA^{-2}$
pH	< 5	7.5 - 8.5
Solubility in water	Chelating agent < 0.1%	EDTA complex > 30%
Toxicity to earthworms	Non-toxic	Toxic

The primary advantage of the elemental iron used in Protect-us Mineral Snail and Slug Killer when compared to iron salts is the inherent safety (a 30 - 150 fold reduction in toxicity). Acute oral toxicity studies in several animal models support this. Indeed this is why elemental iron is the preferred choice for iron supplements including multivitamin tablets, chewable tablets and liquid suspensions.

Study[6]	Species	Elemental Iron LD_{50}	Fe^{2+} LD_{50}	Elemental Iron Safety Factor
Shelanski (1950), Boyd & Shane (1963)	Rat	30,000 mg/ kg	298 - 1,000 mg/kg	30 - 100x
Shelanski (1950), Boyd & Shane (1963)	Guinea pig	20,000 mg/kg	300 - 350 mg/kg	57 - 66x
GAF (1990)	Dog	>25,000 mg/kg	160 mg/kg	156x
ISP (1997)	Young rat	19,000 mg/kg	190 mg/kg	100x

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ACTIVE CONSTITUENT:	Elemental iron powder 10 g/kg (1%)
CONTROLS:	Snails and slugs
MODE OF ACTION	Inorganic, multi-site activity
PACK SIZES:	1 kg and 5 kg Enviropacks
APPROVALS:	APVMA 68516 Australian Organic Registered Input
FORMULATION:	Ready to use pelletised bait optimised for Australian snails and slugs
DIRECTIONS FOR USE:	DO NOT HEAP PELLETS. Scatter pellets on the soil around or near the plants to be protected. Apply bait evenly at approximately **5 g (1 level teaspoon) per square metre or 9 to 10 pellets per 20 cm pot**. Reapply as the bait is consumed or at least every 2 weeks while slugs and/or snails continue to be a problem, or following heavy watering or periods of heavy rain. All likely areas of infestation should be treated, especially the perimeter of vegetable and flower gardens, because these pests move into planted areas from surrounding daytime refuges. Evening is the best time to apply the bait as snails and slugs travel and feed mostly at night or in the early morning. <u>Vegetables, flowers and berry fruits</u> Scatter the bait around the perimeter of the plot and also on the soil around or near the plants. <u>Ornamental shrubs and seedling fruit and citrus trees</u> Scatter the bait in a 15 cm diameter circular band around the base of the plants and also around the perimeter of the plot. <u>Established fruit and citrus trees</u> Scatter the bait around the base of the trees to intercept snails and slugs travelling to the trunks.

ALWAYS READ LABEL DIRECTIONS ON THE PRODUCT BEFORE USE