

ERADICATE

SNAIL & SLUG KILLER

...kills snails and slugs dead!

FOR AGRICULTURAL USE

For the control of certain snails in vineyards, vegetables, strawberries and citrus orchards and for the control of slugs in a range of agricultural and horticultural situations, as specified in the directions for use table.

www.eradicatesnails.com.au

Contents

Contact Details	2
About Us	3
Product Advantages	4
Why Use Iron EDTA?	5
Alkaloid Poppies	8
Canola	9
Cereal Crops	10
Citrus Crops	11
Pasture	12
Pyrethrum	14
Grapes / Vineyards	15
Ornamentals	16
Pulse Crops	17
Vegetables	18
Environmentally Sensitive Areas	19
Identification Chart	20

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About Us

ERADICATE Snail & Slug Killer is marketed by Fair Dinkum Fertilizers.

Fair Dinkum Fertilizers are manufacturers of quality agricultural fertilizer products which are made from seaweed and fish based products. Our extensive range caters for 100% organic products, fortified products with NPK and trace element mixes right through to Animal Nutritional supplements, which when combined consist of over 25 different formulations specific to the many crops and needs of farmers today.

Founded in 2002 by Dr Colin Young and his son James Young, after more than 25 years of consultation, study and product development with many seaweed fertilizer manufacturers around the world, Fair Dinkum Fertilizers was born. Today Fair Dinkum Fertilizers have a solid reputation for some of the finest, if not the best quality liquid seaweed fertilizer products throughout the world today. The consistent supply of quality Australian seaweed, quality control, technical knowledge and dedication to the end user have contributed to this success.

As we have sought to provide the absolute best to the Australian market and to our farmers, we have also established a reputation for extensive research and development. As a result of our comprehensive analysis and experimentation, we have developed technology to make products with pH levels ranging from just above pH 1 to 10.5. This means that whatever the particular need, we can individually tailor a blend to suit your requirements.

As a result of our technology, we have continued this research further into crop protection, which in turn, **ERADICATE** was born. A product that carries no scheduled poisons, is rain fast, effective on juveniles and has no withholding periods on food crops. Added to that, it keeps snails and slugs under control.
ERADCIATE - Kills snails and slugs dead!

Our aim is simple:

We desire to increase the quality and yield of Australian soils.

We are 100% Australian made, and 100% Australian owned.

All of our Seaweed is sourced from the Australian coast.

We will make every effort to provide the Fair Dinkum best every time.

We're 100% Australian, and we're 100% Fair Dinkum.

For further information about Fair Dinkum Fertilizers, please go to:

www.fairdinkumfertilizers.com

www.eradicatesnails.com.au



Deroceras reticulatum



Theba pisana



Cochlicella barbara

Product Advantages

There are many advantages of using **ERADICATE**...

- Active ingredient is allowable food additive
- Application rate between 5 kg/ha (light infestation) up to 15 kg/ha (heavy infestation – over 200 snails per m²).
- Provides over 40% more baiting points than Multiguard
- Non-toxic to pets, native fauna and other animals if used as directed.
- Rain fast
- Active ingredient slowly degrades in moist pellets over several weeks compared to metaldehyde which degrades rapidly
- In over 80 trials **ERADICATE** out performed Australian made metaldehyde pellets
- In typical Australian conditions out performs methiocarb (blue) pellets
- Active ingredient does not accumulate in the environment.
- Unlike metaldehyde can be used up to harvest- no withholding period.
- Unlike metaldehyde can be used near waterways.
- Unlike metaldehyde does not pose a threat to surface or drinking water.
- Effective on juvenile snails.
- Contains child taste deterrent (as required by APVMA).
- Manufactured by a modified “dry” process.
- Patented technology developed by Australian scientists.
- Product designed for Australian conditions.
- Uses “molecular wrap” technology.
- **ERADICATE** woodlice
- After eating **ERADICATE**, snails and slugs stop feeding but do not die immediately. They move away from the bait, so there is no crowding, and die sometime later.
- **ERADICATE** is believed to work by replacing the copper in the oxygen carrier with iron making it ineffective. The mollusk dies of suffocation.

For further information which includes trial data, identification charts and brochures, please go to:

www.eradicatesnails.com.au



Cochlicella barbara



Deroceras panormitanum



Milax gagates

Why Use Iron EDTA?

What baits are available in Australia?

There are basically four types of slug and snail baits available in Australia;

1. Cheap metaldehyde baits made by the so called "dry process" with usually 1.5% metaldehyde as the active ingredient
2. Expensive imported metaldehyde baits made by a wet paste process containing 3-5% metaldehyde
3. Methiocarb baits
4. Iron EDTA Complex baits.

Metaldehyde baits

There are two types of metaldehyde baits available in Australia, imported baits such as Meterex and Slugoff, and Australian baits such as Blitzem, Defender etc. Imported baits use wet process manufacturing which leads to baits which are suitable for slugs and wet soils, whereas the Australian manufactured baits are made by a dry process and perform better in drier conditions than in very wet conditions.

There are several claims for the imported baits which need closer consideration since they have been questioned in the available scientific literature. It is often claimed that "the more baiting points the more effective the bait". This assertion has recently been challenged by a leading scientist at the prestigious Long Ashton research Station in the UK. He claimed that 2.5mm pellets spread at a rate of 32 pellets per m² are the most effective application rate. Both Meterex and Slugoff recommended rates are considerably more than 32 baits per m² and they are much smaller than 2.5mm pellets. Part of the problem with small pellet sizes is that they can fall into small cracks in the soil or between soil aggregates and become inaccessible to slugs and particularly to snails. It is possible that small pellets are more effective under some circumstances but it is certainly not always the case.

In Europe the use of metaldehyde pellets is restricted because it has been found that excess use of this active ingredient has led to levels in some waterways 10 times the allowable concentration*. The application rate of Meterex at 5 kg/ha, (the recommended rate for Meterex in Australia), is higher than is allowable in Europe. This has led to a new 4% metaldehyde product with a recommended application rate of 5kg/ha. This product is not registered in Australia. Another problem in Europe with metaldehyde is that, because of its potential toxicity, its use near waterways is now prohibited. The makers of Meterex likewise recommends use of non-metaldehyde molluscicide for use near waterways.

In Australia there is no restriction on the use of metaldehyde baits near waterways but, in common with Europe there are withholding periods for food crops.

Methiocarb baits

Methiocarb baits are more expensive than Australian manufactured metaldehyde baits and iron EDTA complex baits. They perform better than 1.5 per cent metaldehyde baits and similar to iron EDTA complex baits depending on the situation. Methiocarb is a scheduled poison and its use is restricted on food crops.



Theba pisana



Cochlicella barbara



Deroceras reticulatum

Iron EDTA complex baits

These baits have been particularly developed for Australian snail pests. **ERADICATE** is one of a family of molluscicides developed by scientists associated with The University of Melbourne and La Trobe University. The product is based on molecular wrap technology in which the active ingredient is an iron EDTA complex. Molecular wrap technology can be used to produce an effective snail, slug and woodlice killer which is of low toxicity to non-target animals such as dogs, cats, birds, earthworms. Unlike the active ingredient in baits based on metaldehyde or methiocarb, iron EDTA complex are not a scheduled poisons, and are accepted as an allowable food input.

Extensive scientific trials have shown that **ERADICATE** is effective on all Australian pest snails and slugs. Slugs and snails eat **ERADICATE** and move away from the bait and usually die out of sight. Whilst they do not die immediately they cease feeding. The active ingredient is thought to work by attacking the blood stream of the slug or snail leading to suffocation. The effectiveness of any Snail and Slug Killer depends on numerous factors including the mollusc species, temperature, humidity and attractiveness of the bait as well as the bait formulation. In over 50 trials **ERADICATE** has been shown to be more effective compared with a number of metaldehyde baits with 1.5% active ingredient. In all cases **ERADICATE** gave higher kill rates.

Although only two products based on iron EDTA complex are available in Australia, products based on iron phosphate/EDTA active ingredients are common place in Europe, USA and Canada. These are based on technology which is similar but different from the patented technology used in **ERADICATE**. Extensive research, often sponsored by the suppliers of metaldehyde has been undertaken on the toxicity and fate in the environment of various iron compounds and various iron EDTA complexes. This is in addition to the extensive scientific literature developed as a result of the use and potential use of some iron EDTA complexes in food stuffs, (including work by Kelloggs for inclusion of iron EDTA complexes in breakfast cereals), and in medical applications to treat anaemia due to iron deficiencies which effects about 60% of the world's population. The results of these studies may be summarised by noting that there was no significant harm to the environment and human health. Furthermore, provided label instructions are adhered to, there is no significant potential to cause harm to non target animal or plant species.

Despite claims by various organisations and interest groups there is no evidence for death of family pets due to iron poisoning. In comparison products based on metaldehyde have been responsible for literally hundreds of dog deaths in Australia. **ERADICATE** is toxic to snails, slugs and woodlice and whilst there is some evidence that excessive consumption of Iron EDTA complex baits leads to vomiting and diarrhoea these effects are probably due to the alkaline nature of the product. Reports by some veterinary publications claiming toxicity due to iron poisoning are based on invalid assumptions, incorrect calculations and flawed scientific reasoning. There is circumstantial evidence of poisoning, not death, but this has not been conclusively linked to consumption of iron.

In Europe and USA, products based on iron phosphate and EDTA have been investigated for the potential threat to earthworms. These trials show that at very high dose rates there is a potential to reduce earthworm growth rates but the results were not statistically significant. Indeed, the only significant conclusions from the trials were that earthworms can remove snail and slug pellets from the soil surface reducing their effectiveness. There is no evidence what so ever to support the claim made by some interest groups, that iron EDTA pellets when used as molluscicides, are toxic to earthworms.

The removal of pellets from the soil surface has been investigated and it appears that it is less of a problem with iron phosphate/EDTA pellets than with metaldehyde pellets, However, this observation may be a consequence of the smaller size of the metaldehyde pellets used in studies rather than any intrinsic property of the active ingredient.

Summary

The properties of the various types of snail and slug pellets on the Australian market are summarised below;

	Metaldehyde Dry Process	Metaldehyde Wet Process	Methiocarb	Iron EDTA complex
Typical cost per kg	\$1.30 - \$2.00	\$8.00 - \$11.00	\$5.00	\$3.00 - \$3.50
Effectiveness	Poor / Moderate	Good	Good	Good
Toxicity to dogs, birds and other non target species	High	High	Very High	Low
Danger to water supply	Moderate	High	?	Low
Withholding period on food crops	Yes	Yes	Yes	No
Active ingredient	Scheduled Poison	Scheduled Poison	Scheduled Poison	Food Ingredient

From this table the answer to the question "Why use iron EDTA complex baits rather than metaldehyde or methiocarb baits?" is obvious.

* Metaldehyde in drinking water www.getpelletwise.co.uk

Alkaloid Poppies

Slugs are a significant problem in alkaloid poppy production in Tasmania. The most prevalent pest slug is *Deroceras reticulatum*, the grey field slug, but other slugs such as *Deroceras panormitanum*, the brown field slug and *Milax gagates*, the black-keeled slug can also be pests. Some of the most devastating problems in poppies occur because slugs attack the emerging seedlings and it is not uncommon that the damage is so severe that the seed has to be re-sown, sometimes even a third time. The sowing of poppies in spring coincides with peak slug activity.

Slugs move into the soil during the day and emerge over night feeding on the soil surface up to dawn. Slugs can eat several times their own weight in one night. Slug numbers build up rapidly in wet seasons and tend to increase when the land has been used for pasture for several years. Cultivation reduces slug numbers, and slug numbers may be reduced by natural predators such as, black shiny beetles called carabid beetles. Unfortunately carabid beetles are killed by broad spectrum insecticides, (including metiocarb) and their numbers are reduced by cultivation and heavy grazing.

Slug numbers are generally higher in moister parts of paddocks and lower on any ridges. It is worthwhile checking slug numbers by setting slug traps. This will enable the grower to check which part of the paddock is most infected, and if it is necessary to bait all or just some of the paddock. Simple slug traps can be made by cutting a piece of masonite about 30 x 30cms, drilling a hole in the centre and securing it to the soil by means of a steel tent peg. It is important that the smooth surface is in contact with the soil and there is good soil/trap contact. Putting a small amount of chicken pellets under the trap will help attract the slugs to the trap. The trap should be checked pre- dawn. If there are two slugs or more under the trap **ERADICATE** Snail and Slug Killer should be used to reduce numbers. Unlike most slug killer products **ERADICATE** does not work by desiccation so there is no possibility of rehydration under cool moist conditions. The active ingredient in **ERADICATE** is an iron EDTA complex based, Ferric EDTA oxo-dimer, which is effective under cool moist conditions. It is important to apply slug baits several days before sowing. Baits are most likely to be eaten when there is little alternative feed.

ERADICATE should be applied at a rate of 5 kg/ha for light infestations up to 15 kg/ha for heavy infestations. To be effective the soil needs to be moist but if very heavy rain is expected it is advisable to delay treatment until after the storm has passed.



Deroceras reticulatum



Deroceras panormitanum



Milax gagates

Canola

On a world scale canola, (oil seed rape), is the crop most severely damaged by slugs. In Australia, under moist conditions, snails & slugs can also pose a threat to canola crops. Slugs do not thrive in dry conditions and most slug species, unlike most snail species, lay several clutches of eggs throughout the year including in summer. White snails lay clutches of eggs in autumn soon after the end of aestivation. The eggs of both slugs and snails only mature in moist conditions.

Most of the problems with slugs in canola occurs at sowing or in the early stages of growth. It is common practice in Europe to mix snail and slug baits with the seed at sowing so the molluscicide is directly sown along with the seed. This is an effective way of killing slugs travelling the drill lines and relatively little molluscicide is needed. However, application in drill lines requires the pellet to be more water resistant and harder than what is optimum for pellets that are applied to the soil. Also any slugs not travelling along the drill lines will attack the seedlings as soon as they emerge above the soil surface. If slugs are a potential problem it is recommended that baiting on bare soil occur 4 or 5 days before sowing if the soil is moist. Snails can attack seedlings but the main problem with snails arises because snails climb up the stalks and aestivate which then contaminates the harvest. Also if the plants are windrowed, snails can climb up into the plant off the soil surface and contaminate the crop. It is possible to separate snails from the seeds but every effort should be made to reduce the number of snails before harvest.

It is important to establish how severe the infestation is before applying **ERADICATE**. Slug traps need to be placed throughout the area to be sown. Usually about 1 trap per one or two acres is needed. Generally slug infestations will be higher in the damper areas of the growing area and are likely to be high near any grass/pasture area such as the field margins. Slugs congregate in areas where they can consume roots. Areas which have recently been used for pasture often have a higher proportion of organic matter and a higher level of slug infestation. Furthermore, generally if there is a high level of crop trash on the soil surface slug numbers tend to be higher. There are various designs of slug traps including some commercially available products. However it is easy to make suitable traps by cutting a masonite sheet into squares about 30 cms x 30 cms and drilling a hole in the middle. These traps are placed on a level area of soil and secured by a "tent" peg through the hole in the middle. It is important that the trap sits snugly on the soil surface as any draught under the trap will reduce the number of slugs caught. Usually a few chicken pellets are spread over the soil surface before securing with the steel peg. If the underside of the trap is inspected within a half an hour of dawn slugs will be found if slugs are present. If there are any slugs under more than half the traps, baiting is recommended.

If there is considerable crop trash on the soil surface, rolling or burning will reduce number of white snails considerably. This is best done before the end of summer. If there is a high infestation of white snails **ERADICATE** can be applied to the growing crop, provided the soil is moist and the weather cool. The recommended application rate is 5 kg/ha for light infestations and up to 15 kg/ha for heavy infestations.



Deroceras reticulatum



Theba pisana



Cochlicella barbara

Cereal Crops

Historically slugs and snails have, up until a couple of decades ago, been a fairly unimportant pest in cereal crops across Australia. Today, slugs and snails in particular heavily threaten the industry. There have even been instances of whole sowings being destroyed.

The slug problem has become more important as minimum or no till methods become widespread and stubble burning has been reduced. Slugs either hollow out seeds in the drill lines or attack plants soon after emergence. Slugs move into the soil during the day and emerge over night feeding on the soil surface up until dawn. Slugs can eat several times their own weight in one night. Slug numbers tend to build up rapidly in wet seasons and tend to increase when the land has been used for pasture for several years. Cultivation reduces slug numbers and slug numbers may be reduced by natural predators such as black shiny beetles called carabid beetles. Unfortunately carabid beetles are killed by broad spectrum insecticides (including methiocarb) and their numbers are also reduced by cultivation and heavy grazing. The snail problem for cereal crops arise from the white snails usually either the small conical snail, *Cochlicella barbara* or the Italian snail, *Theba pisana*. These snails will attack the seedlings at emergence but more damage is done by contamination of the crop at harvest.

White snails mate and lay clutches of eggs in or on the soil in spring and then as summer approaches they climb up weeds, stalks and fence posts etc to get off the soil surface. They then seal off the entrance to their cell and slow the body functions down in a process called aestivation. On cooler damp days they reverse the process and will come down to the soil to feed. When it warms up again they aestivate again. The problem with cereals arises if harvest occurs on warm to hot dry days. There are various ways to minimize the number of snails collected in the harvest and ways of cleaning the grain but these procedures are not 100% effective and add to production costs.

It is worthwhile checking slug numbers by setting slug traps. This will enable the grower to check which part of the paddock is most infected and if necessary bait all or just some of the paddock. Slug numbers tend to be higher in moister parts of paddock and lower on ridges. Simple slug traps can be made by cutting a masonite piece about 30 x 30cms, drilling a hole in the centre and securing it to the soil by means of a steel tent peg. It is important that the smooth surface is in contact with the soil and there is good soil - trap contact. Putting a small amount of chicken pellets under the trap will help attract the slugs to the trap. The trap should be checked pre- dawn, and if there are two slugs or more under the trap then **ERADICATE** Snail and Slug Killer should be used to reduce numbers.

It is important to apply slug baits several days before sowing. Baits are most likely to be eaten when there is little alternative feed. If slug numbers are high it is possibly better to bait at half the chosen application rate 4 to 5 days before sowing and to apply a second treatment again at half rate at emergence or soon after.

If white snails are a problem at sowing apply **ERADICATE** at 5 kg/ha to 15 kg/ha depending on the infestation at sowing or up to 1 week after emergence. Two applications at half rate separated by two weeks or so may be more effective than 1 application. Usually it is not possible to bait just prior to harvest, but may be possible mid season if the infestation has built up.



Theba pisana



Cochlicella barbara



Deroceras reticulatum

Citrus Crops

The production of oranges and lemons is an important industry for local and export markets. In Australia the potential contamination of crops by snails is a significant problem particularly for the export market. The main snail pests are the common garden brown snail (*Helix aspersa* or *Cantareus aspersus* as it is now called) and the small brown snail, *Microxeromanga vestita*. The small brown snail has established itself in the Riverland and Sunraysia districts and is now becoming established in the Riverina district. Infestations of up to 8000 per square metre have been reported. The control of these snails has, in general, been less than completely satisfactory. In order to control the snails it is necessary to understand the lifecycle of the snails and their ecology. The lifecycle of the small brown snail in citrus orchards appears to be typical of snails of the Helicidae and Hygromiidae families. The eggs hatch in late autumn to early spring, the snails grow during spring, towards the end of spring they cease feeding, climb up into the trees and aestivate (ie they stop feeding, close themselves off with a layer of mucus and slow their metabolism down). At the first autumn rains they descend to the soil, start feeding and mate. Subsequently they lay eggs and the lifecycle starts again. The period of aestivation depends on the season and location.

There are a number of cultural practices that can reduce the problem and these should be integrated with chemical treatment. It is important that good hygiene is practised throughout the orchard. All rubbish, such as packing material/pallets should be removed. All prunings should be removed and it is important to minimise leaf litter/grass consistent with overall orchard practice. Leaf litter will reduce moisture lost but significantly increase the snail problem. The trunk is an important access point for snails to climb up into the tree. Skirting of the trees, that is removing branches that touch the ground is a good way to reduce the number of snails in trees. Chemical control needs to be targeted carefully. It is extremely important that the numbers of snails are not allowed to build up to severe pest levels as it is difficult to get severely infested orchards back to acceptable levels within two years even with extensive baiting.

The common brown snail and small brown snail can be treated by applying **ERADICATE** at a rate of 2.5 kg/ha for mild infestations and up to 7.5 kg/ha for significant infestations (assuming only the area under the canopy is treated). Two treatments are recommended. The best time to apply baits is after the snails have ceased aestivating but before mating, usually end of March and April. There is a fairly small time window, the dates of which vary from season to season. The second best period to apply baits is in spring when the snails are on the soil and feeding. This is usually a much larger window of time but snails often climb the trees or vines before aestivating. It is important to place the bait under the canopy of the tree. This area is out of the reach of birds, which might consume the bait and is generally moist but out of the rain which allows **ERADICATE** to be effective for an extended period of time.



Microxeromanga armillata



Helix aspersa



Pasture

The Grain Research and Development Corporation, (GRDC), and the Department of Agriculture (WA) have published a number of useful guides regarding the control of white snails in Australia. Farmers with significant white snail problems should consult the articles available on the internet. This article is designed to be read in conjunction with these articles and focuses on the baits in more detail. Baits should only be regarded as part of the control strategy. In most cases the use of "Burning and Bashing" may also be part of the strategy.

There are four white pest snails in Australia:

1. *Cernuella virgata*
2. *Cochlicella acuta*
3. *Theba pisana*
4. *Cochlicella barbara*.

The first two feed mainly on dead material whereas the second two mainly prefer living material. Dr Geoff Baker and coworkers have investigated if the snails of the first three species are attracted to particular foods but it appears that there is, in general, no particular food that attracts any species. They concluded that there was little advantage in incorporating any particular food as an attractant. The active ingredients commonly available in snail baits in Australia are metaldehyde, methiocarb and iron EDTA complex. These active ingredients work by different mechanisms. The size of the pellets also differ considerably between products as does the water fastness, efficacy, concentration of active ingredient and cost.

Metaldehyde baits have been available for several decades in Australia. Most products have 15 g/kg of metaldehyde. At least two products imported from Europe have a higher concentration and whilst it appears that these products are more effective their cost (over \$8000 per tonne) means they have little potential for the white snail problem in broad acre agriculture. Metaldehyde is highly toxic to non target baits such as mammals and birds. This has lead to the development of products with a higher concentration of metaldehyde, with much lower application rates and very small pellets.

Methiocarb baits are a much newer addition to the snail control arsenal. Methiocarb is more toxic than metaldehyde and Australian versions of methiocarb bait (Baysol and Mesurol) are generally more effective than the common Australian metaldehyde baits.

Iron EDTA complex baits are an Australian invention which are both effective and relatively cheap. The first product was released in 1996. Ferric EDTA is degraded in UV light and whilst there no evidence that it could accumulate in the environment at present usage. Fe EDTA is widely used to treat iron deficiencies in both plants and animals. It is also used in a wide range of industrial and domestic products. Less than 1% of world production is used in snail pellets. Eradicate, is based on a 6% Ferric EDTA complex and is effective against all known Australian pest terrestrial mollusks including juvenile white snails. It gives the farmer with land infested with white snails an important addition to their arsenal.



Deroceras reticulatum



Deroceras panormitanum



Milax gagates

Active Ingredient	Mode of action
15-50 g/kg Metaldehyde	Irritant which causes excess mucus secretion and desiccation; nerve poison at high concentrations
20 g/kg Methiocarb	Inhibits nervous system.
60 g/kg Fe EDTA	Stomach poison, which is believed to reduce the oxygen carrying capacity of the mollusk "blood".

Useful resources:

ERADICATE should be used at between 5 kg/ha (for light infestations) up to 15 kg/ha for severe infestations. Directions for use, including timing, for specific crops and further details are given on the **ERADICATE** website.

www.eradicatesnails.com.au

Bash 'Em, Burn 'Em Bait 'Em –integrated snail management in crops and pastures

www.grdc.com.au/Media-Centre/Bookshop/

Snail Back Pocket Guide

www.grdc.com.au/Media-Centre/Bookshop/

GRDC Pestlinks

www.grdc.com.au

Bulletin 4713

Identification and control of pests, slugs and snails for broadacre crops in Western Australia

www.agric.wa.gov.au

Ground Cover TV: Snails

www.grdc.com.au/GCTV

Pyrethrum

The slug and snail problem in pyrethrum is important from three aspects. During the establishment phase snail and slug numbers can be high enough to damage the young seedlings. The extent of this problem depends largely on the previous crop in the rotation and the extent of cultivation since the last crop. Once the plants are established slug and snail numbers gradually build up unless baited. The pyrethrum provides ample shelter and a moist environment for both snails and slugs. At this stage both slugs and snails can severely damage new young shoots which would have borne flowers. This significantly reduces the yield of pyrethrum. After cropping is discontinued and the next phase of the rotation is to be established slug numbers may be extremely high so that extensive and often multiple baiting is necessary to reduce the level of the infestation. In the middle cropping stage damage to the plants including flowers can be highly significant. Both slugs and snails are attracted to young shoots and slugs are particularly attracted to flower buds. (The attraction to flower buds is thought to be due to sugars which finally reside in the nectar. The problem occurs in other flowers such as daffodils). Damaged flower buds do not mature properly.

In Tasmania the grey field slug is likely to be the most prominent slug pest but in Victoria the black keeled slug and even the brown field slug may be a problem. In Tasmania the common garden snail is likely to be the most common snail pest but other snails such as the small conical snail are established in a few locations. The grey field slug is a shallow soil dweller and feeds at the soil surface whereas the black keeled slug lives deeper in the soil and feeds to a large extent on roots and may not surface to feed for several days. Usually about 1 trap per acre is needed. Generally slug infestations will be higher in the damper areas of the growing area and are likely to be high near any grass/pasture area such as the field margins. Slugs congregate in areas where they can consume roots or young shoots. Areas which have a higher proportion of organic matter often have a higher level of slug infestation.

There are various designs of slug traps including some commercially available products. However it is easy to make suitable traps by cutting a Masonite sheet into squares about 300 mms x 300 mms and drilling a hole in the middle. These traps are placed on a level area of soil and secured by a "tent" peg through the hole in the middle. It is important that the trap sits snugly on the soil surface as any draught under the trap will reduce the number of slugs caught. Usually a few chicken feed pellets are spread over the soil surface before securing with the steel peg. If the underside of the trap is inspected within a half an hour of dawn slugs will be found if slugs are present.

If an average of more than one slug is found under each 300mm x 300mm trap baiting should be applied at 5-8 kg/ha. If more than four slugs are found baiting at up to 15 kg/ha should be applied. Slug traps do not give an accurate estimation of black keeled slugs but are fairly reliable for the grey field slug. The best time to bait is after rain but not if rain is expected within the next 24 hours. Slugs are attracted to baits over quite large distances but snails are only attracted over very short distances.

An identification chart of slug and snail species can be found at www.eradicatesnails.com.au



Helix aspersa



Deroceras reticulatum



Grapes / Vineyards

Snails in vineyards are significant pests and the problem is increasing due to white snails infesting new areas. The snail pests can conveniently be grouped into four groups.

1. The common garden snail, *Helix aspersa*,
2. The white snails, *Cernuella virgata*, the common white snail and *Theba pisana* the Italian snail
3. The conical white snails. There are two major pests, the small pointed snail *Cochlicella barbara* in which the ratio of the length to diameter is 2 or less and the pointed snail, *Cochlicella acuta*, in which the ratio of the length to diameter is greater than 2. *Cochlicella barbara* is the more common and is becoming a pest in some vineyards.
4. The small brown snail, *Microxeromanga vestita*, This snail is particularly common in the irrigated orchards in the Riverland-Mildura area.

The main damage from snails is due to contamination either directly with the snails being present on the fruit or more likely the skin of the fruit being damaged and becoming infected with fungi.

ERADICATE has been shown to be effective on all these pests but in order to control the snails it is necessary to understand the lifecycle of the snails and their ecology. The lifecycle of the small brown snail and the white snails in vineyards appear to be typical of snails of the Helicidae family. The eggs hatch in late autumn to early spring, the snails grow during spring then towards the end of spring, they cease feeding, climb up into the vines and aestivate (ie they stop feeding, close themselves off with a layer of mucus and slow their metabolism down). At the first autumn rains they descend to the soil, start feeding and mate. Subsequently they lay eggs and the lifecycle starts again. The period of aestivation depends on the season and location.

It is important that good hygiene is practised throughout the vineyard. All rubbish, such as packing material/pallets should be removed. All prunings should be removed and it is important to minimise leaf litter/grass consistent with overall vineyard practice. Leaf litter will reduce moisture lost but significantly increase the snail problem. The vine trunk is an important access point for snails to climb up into the vine, and removing vine branches that touch the ground are good ways to reduce the number of snails in the vines. The best time to apply baits is after the snails have ceased aestivating but before mating. There is a fairly small time window, the dates of which varies from season to season but is normally about the end of March to April. The second best period to apply baits is in spring when the snails are on the soil and feeding. This is usually a much larger window of time but snails often climb the trees or vines before aestivating. It is recommended to apply **ERADICATE** at a rate of 5 kg/ha for mild infestations (up to 150m²) and up to 15 kg/ha for very severe infestations (more than 800m²). One application should be made when the snails return to the soil after aestivation in March/April and another one or two if required during the winter early spring. In early spring the baits are likely to be consumed more quickly than in winter when the snails are less active.



Theba pisana



Cochlicella barbara



Ornamentals

There have been numerous studies on the attractiveness of plants to snails and slugs. Ornamentals in particular appear to be attractive to specific species of slugs and snails. **ERADICATE** has been shown to provide effective control of slugs and snails for a wide range of ornamentals.

From the most detailed studies on white snails it appears that growing plant material is not particularly attractive to two of the four pest species. *Cernuella virgata* and *Cochlicella acuta* consume dead plant material in preference to living plants whereas the reverse is true for *Theba pisana* and *Cochlicella Barbara*. The common brown snail, *Helix aspersa*, (or *Cantareus aspersus* as it is now known) is a ferocious eater of seedlings. On the other hand it is generally agreed that slugs are attracted to certain plants and indeed certain parts of plants. For example, slugs are attracted to the buds of daffodils. Because slugs spend some time in the soil they often consume seeds or hollow out seeds. Generally, in Australia the slug problem is a severe problem in relatively small agricultural areas (the area around Esperance, relatively small areas in South Australia, Victoria and most of Tasmania) but tend to be more widespread in home gardens and horticulture because of higher soil moisture as a result of irrigation. Slugs end their day returning to the soil or under stones or logs etc, and emerge at night for feeding. In ornamentals the most common problem caused by slugs is at the seedling stage. Often slugs eat the seedlings at ground level but generally do not consume the whole seedling, although they do kill the seedlings. Bran and sugars such as those which occur in nectar, appear to be attractive to slugs such as *Deroceras reticulatum*.

Before applying **ERADICATE** to deal with a slug infestation it is advisable to establish how severe the infestation is. Simple slug traps can be made by cutting a masonite board about 30 x 30 cms, drilling a hole in the centre and securing it to the soil by means of a steel tent peg. It is important that the trap is in good contact with the soil and the smooth surface is in contact with the soil. Putting a small amount of chicken pellets under the trap will help attract the slugs to the trap. The trap should be checked pre-dawn. If there are any slugs under the trap, then **ERADICATE** Snail and Slug Killer should be applied.

In ornamentals infested with white snails it is important to realise that white snails eat bait **ONLY** when they are on the soil and this usually occurs at night. If the weather is hot and dry the snails will remain on plants until the weather changes and the soil becomes damp. Generally, white snails are more difficult to control than the common brown snail because of the habit of climbing up plants. Even if the soil is damp white snails tend to climb up onto plants during the day and come down in the evening. In the case of white snails, better control may be obtained by two or more applications at 5-10 kg/ha even for moderate to severe infestations.

Generally, if there is a lot of plant trash surrounding ornamentals, the effectiveness of any bait treatment on white snails is reduced. This appears to be due to the fact that white snails, particularly in the case of the conical snails, which "hide" in crop trash and may not even go down to the soil surface to feed. Avoid using any mulch if conical snails are a problem. Slugs and the common brown snail can be treated by applying **ERADICATE** at a rate of 5 kg/ha for mild infestations and up to 15 kg/ha for significant infestations.



Theba pisana



Cochlicella barbara



Pulse Crops

Both slugs and snails may be a pest to pulses. Slugs can attack germinating seeds before emergence and snails, particularly the small conical snail, *Cochicella barbara*, may attack seedlings as they emerge. If the slug or snail numbers are high they can lead to a virtual wipeout of the crop. Once the crop is established, slugs and snails generally do not cause severe damage, however if snails and slugs are present at harvest, pulse crops may be downgraded or in extreme cases written off as a complete loss. Slugs move into the soil in the day and emerge over night, feeding on the soil surface up until dawn. Slugs can eat several times their own weight in one night. Slug numbers tend to build up rapidly in wet seasons and tend to increase when the land has been used for pasture for several years. Cultivation reduces slug numbers and slug numbers may also be reduced by natural predators such as black shiny beetles called carabid beetles. Unfortunately carabid beetles are killed by broad spectrum insecticides including methiocarb and their numbers are reduced by cultivation and heavy grazing.

It is worthwhile checking slug numbers by setting slug traps. This will enable the grower to check which part of the paddock is most infected, and if it is necessary to bait all or just some of the paddock. Slug numbers tend to be higher in moister parts of the paddock and lower on any ridges. Simple slug traps can be made by cutting a masonite piece about 30 x30cms, drilling a hole in the centre and securing it to the soil by means of a steel tent peg. It is important that the smooth surface is in contact with the soil and there is good soil - trap contact. Putting a small amount of chicken pellets under the trap will help attract the slugs to the trap. The trap should be checked pre- dawn. If there are two slugs or more under the trap then **ERADICATE** Snail and Slug Killer should be used to reduce numbers. It is important to apply slug baits several days before sowing. Baits are most likely to be eaten when there is little alternative feed. If slug numbers are high it is possibly better to bait at half the chosen application rate 4 to 5 days before sowing, and to apply a second treatment again at half rate at emergence or soon after. If snails or slugs are a problem it is best to apply **ERADICATE** pre-emergence. If snails are still a problem as harvest approaches and the soil is moist a second treatment can be made. There is no withholding period for **ERADICATE** but, of course it would be preferable not to apply too late so that pellets are harvested with the crop. The small conical snail does not aestivate as readily as the other white snails, so if the soil is moist they are likely to be feeding on the soil surface.

ERADICATE should be applied at a rate of 5 kg/ha for light infestations up to 15 kg/ha for heavy infestations. To be effective the soil needs to be moist but if very heavy rain is expected it is advisable to delay treatment until after the storm has passed.



Cochicella barbara



Cochicella barbara



Vegetables

The most common pest mollusk in vegetables are slugs, but white snails are becoming an increasing problem along with the common brown garden snail. These three groups of pests need to be treated slightly different but **ERADICATE** is effective on all three groups. However, no bait is effective when the white snails aestivate, that is they climb up into the vegetable and seal off their shell. This happens in summer on hot dry days. The snails are capable of remaining in this state for months. Although they do not consume food whilst aestivating they contaminate the crop and obviously they need to be removed if the crop is for human consumption.

From the most detailed studies on white snails it appears that growing plant material is not particularly attractive to two of the four pest species. *Cernuella virgata* and *Cochlicella acuta* consume dead plant material in preference to living plants whereas the reverse is true for *Theba pisana* and *Cochlicella barbara*. The common brown snail, *Helix aspersa*, (or *Cantareus aspersus* as it is now known) is a ferocious eater of seedlings. On the other hand it is generally agreed that slugs are attracted to certain plants and indeed certain parts of plants. Slugs are widespread in home gardens and horticulture because of higher soil moisture as a result of irrigation. Slugs spend most of the day in the soil or under stones or logs etc, and emerge at night for feeding.

In vegetables the most common problem caused by slugs is at the seedling stage. Often slugs eat the seedlings at ground level but generally do not consume the whole seedling, although they still kill the seedlings. Bran and sugars such as those which occur in nectar, appear to be attractive to slugs such as *Deroceras reticulatum*. Before applying **ERADICATE** to deal with a slug infestation it is advisable to establish how severe the infestation is. Simple slug traps can be made by cutting a masonite board about 30 x 30cms, drilling a hole in the centre and securing it to the soil by means of a steel tent peg. It is important that the trap is in good contact with the soil and the smooth surface is in contact with the soil. Putting a small amount of chicken pellets under the trap will help attract the slugs to the trap. The trap should be checked pre-dawn. If there are any slugs under the trap then **ERADICATE** Snail and Slug Killer should be applied. In vegetables infested with white snails it is important to realise that white snails eat bait only when they are on the soil and this usually occurs at night. If the weather is hot and dry the snails will remain on plants until the weather changes and the soil becomes damp. Generally, white snails are more difficult to control than the common brown snail because of the habit of climbing up plants. Even if the soil is damp white snails tend to climb up onto plants during the day and come down in the evening. In the case of white snails better control may be obtained by two or more applications at 5-10 kg/ha even for moderate to severe infestations.

Generally, if there is a lot of plant trash surrounding vegetables the effectiveness of any bait treatment on white snails is reduced. This appears to be due to the fact that white snails, particularly in the case of the conical snails which "hide" in crop trash may not even go down to the soil surface to feed. Avoid using any mulch if conical snails are a problem.

Slugs and the common brown snail can be treated by applying **ERADICATE** at a rate of 5 kg/ha for mild infestations and up to 15 kg/ha for significant infestations.



Helix aspersa



Cochlicella barbara



Deroceras reticulatum

Environmentally Sensitive Areas

The use of snail baits in environmentally sensitive areas and public amenity areas such as conservation areas, sporting grounds, road sides and next to waterways requires care and the correct choice of product. The majority of Snail and Slug baits available commercially in Australia have one of three active ingredients. The table below gives a summary of the major relevant properties of baits based on these active ingredients.

Active ingredient	Withholding period	MRL	Use near waterways	Compatible with IPM	Colour	Toxic to slaters	Toxic to non target species	LD50 of active rat (oral)
Metaldehyde	Yes	Yes	No	??	Green	No	Yes, birds and mammals	0.6g/kg
Methiocarb	Yes	Yes	No	No	Blue	Yes	Yes, birds mammals insects	0.03g/kg
Iron EDTA	No	No	Yes	Yes	Yellow	Yes	No, except yabbies and other crustacean	>5g/kg

From this table it is clear that pellets with iron EDTA complex baits are by far the preferred bait for use in environmentally sensitive areas. The Iron EDTA complex products **ERADICATE** Snail and Slug Killer (Yellow) and **ERADICATE** Snail and Slug Bait (Red) have identical pellet size and formulation apart from the colour. Iron EDTA is an allowable food additive and is widely used as such. Iron EDTA is widely used to treat iron deficiency in humans and Kelloggs have a patent to include it in cereals preparations. It is also used in cosmetics and in cleaning products. About 3% of world production is used in treating iron deficiencies in crops and pasture. Currently about 1% is used in snail and slug baits. The amount per hectare used to treat iron deficiency is much greater than that would be supplied by treatment with **ERADICATE**. **ERADICATE** should not be directly applied to waterways to kill aquatic snails because it is toxic to crustacea. However, the run-off from land immediately adjacent to waterways treated with **ERADICATE** as per the label instructions does not pose a threat to aquatic organisms. The iron content of run-off water will be far below the toxic level. **ERADICATE** poses no threat to non target organisms or natural predators of snails and slugs such as carabid beetles when used as directed. **ERADICATE** contains a pH modifier and taste deterrent (as required for all molluscicides by the APVMA). The taste deterrent makes consumption of more than a few grams by children extremely unlikely. The pH modifier may cause animals that gulp their food, such as dogs, to vomit and possibly have diarrhea but this will only occur if the label instructions re storage and/or application rate are totally ignored. The fact that the Australia regulatory authority does not impose withholding period on the products on food crops, their use has no restrictions near waterways and they are compatible with integrated pest management can be used near waterways is consistent with the GRAS (Generally Regarded As Safe) classification of iron EDTA by the USA FDA and the conclusions of the European food Safety Authority.



Theba pisana



Cochlicella barbara



Deroceras reticulatum

Identification Chart

Listed below are just some of the more prominent pest snails and slugs within Australia.
(Images shown are not to scale).



Cantareus aspersus
(Common garden snail, Brown Snail,
Speckled Escargot)



Cernuella virgata
(Vineyard Snail, Common White
Snail Striped Snail)



Theba pisana
(White Snail, Italian Snail
Small Grey Snail)



Cochlicella barbara
(Small Conical, Small Pointed Snail
Banded Conical Snail)



Cochlicella acuta
(Pointed Snail)



Microxeromagna armillata
(Small Brown Snail, Citrus Snail)



Cantareus apertus
(Green Snail)



Milax gagates
(Jet Slug)



Deroceras panormitanum
(Brown Field Slug, Caruna Slug,
Sicilian Slug)



Limax maximus
(Great Grey Slug, Tiger Slug, Leopard
Slug, Great Striped Garden Slug)



Arion hortensis
(Small Striped Slug)



Arion ater
(Black Slug)



Arion intermedius
(Hedgehog Slug)



Deroceras reticulatum
(Grey Field Slug, Milky Slug)



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