In their lifetimes, slugs will travel only a few metres from their hatching site, in a circular route, in search of food.

Life cycle

All slug species are hermaphrodite (each individual is both male and female). While some species are self-fertile, most mate before laying eggs in batches of 10 to 50 in soil cavities, between clods, under stones or at the base of plants. Up to 500 eggs per slug may be laid over several weeks. Eggs develop slowly in the winter but will hatch within a few weeks when the temperature starts to rise. In their lifetime, slugs will travel only a few metres from their hatching site, in a circular route, in search of food.

Importance

Oilseed rape

Slugs are most damaging to seedlings because the growing point of a germinating oilseed rape shoot is, unlike cereals, above ground. Serious damage (picture below) occurs up to the four true leaf stage. Kill up to 50 seeds in the first week after sowing, indicating the need for immediate control. Weight-for-weight, smaller slugs destroy more seeds than larger slugs.

Cereals

Slugs are most damaging when they cause seed hollowing. Each slug can kill up to 50 seeds in the first week after sowing, indicating the need for immediate control. Weight-for-weight, smaller slugs destroy more seeds than larger slugs.

Feeding on shoots and leaf shredding is also important and cereals are most vulnerable up to GS14 (four leaves unfolded) but remain vulnerable up to G21 (one main shoot and one tiller).

Potatoes

Slugs are most damaging at the early stages of tuber bulking. They enter through small holes in the skin, causing irregular-shaped holes on the tuber surface extending into large cavities in the tuber (below).

Latest information

- Metaldehyde can be detected in raw (untreated) water above the drinking water standard and was widely detected above the standard in autumn 2012.
- Unless action is taken, regulatory restrictions may be enforced.
- A new online tool, ‘What’s in Your Backyard’, is available from the Environment Agency at www.wiyby.co.uk

Action

- Put slug traps out before cultivation to assess slug risk.
- Monitor slug activity throughout the susceptible crop growth stages.
- Find out if you are in a Drinking Water Protected Area or Safeguard Zone using the new tool at www.wiyby.co.uk
- Refer to the metaldehyde stewardship guidelines at www.getpelletwise.com

Always read product labels, consider your local conditions and consult a professional BASIS-qualified agronomist, if necessary.
Key slug species

The grey field slug (*Deroceras reticulatum*) and other *Deroceras* spp.
The grey field slug is the most widespread and troublesome species. It continues to be active in damp weather and even when temperatures are close to freezing. Breeding is generally at a peak in April and May and then again from September to October. However, in favourable conditions, it will breed throughout the year. In optimum conditions it can start to lay eggs within 16 weeks of hatching. The grey field slug, usually light grey or brown, grows to 5 cm in length and produces milky white mucus when irritated.

The garden slug (*Arion hortensis* and *Arion distinctus*)
The garden slug is usually smaller than the grey field slug. The body is dark and the foot (underside) ranges from yellow to orange. It produces orange or yellow mucus. Egg hatching reaches its peak from late spring/early summer. *Arion* species are only active at temperatures above 5°C and are less active on the soil surface than the field slug.

The keeled slug (*Milax, Tandonia* and *Boettgerilla* spp.)
Keeled slugs are more localised in arable crops than field or garden slugs but they can be important. They have annual life cycles, with eggs hatching from autumn to spring. All keeled species are generally subterranean but can be seen on the surface, especially during the breeding season.

Risk factors

Moisture and temperature
Activity, survival and reproduction are dependent on moisture. The optimum temperature for slugs is 17°C.

Soil types
Slugs are more abundant in heavy soils with high clay or silt content.

Previous cropping
Slug damage is much greater after leafy crops. Oilseed rape is very dense and leafy in its early growth stages (creating moist soil conditions) compared to potatoes, which sees vegetative growth later on.

Crop residues, organic matter and weeds
Crop residues or applications of manure, especially in the autumn, as well as weeds and volunteers, provide slugs with a source of food and shelter.

Cultivation
Direct drilling, as well as delayed drilling, increases the risk of slug damage.

Seedbed preparation
Open and cloddy seedbeds allow slugs easy movement.

Other agronomic conditions
Lack of nutrients, poor drainage and weed competition can all result in slow growth, prolonging the vulnerable period of establishment.

Risk assessment

The best time to monitor slugs is when the weather is mild and the soil is damp. Sampling in the field is best done using refuge traps. Traps provide valuable information on slug activity.

Put slug traps out before cultivation, when the soil surface is visibly moist and the weather mild (5–25°C). Traps consist of a cover about 25 cm across, with a small heap (2 heaped spoonfuls) of chicken layers’ mash (NOT slug pellets) beneath.

In each field, nine traps (13 in fields larger than 20 ha) should be set out in a ‘W’ pattern. Also concentrate on areas known to suffer damage. Leave traps overnight and examine early the following morning.

The following thresholds indicate a possible risk when soil and weather conditions favour slug activity.

**Winter cereals:** a catch of 4 or more slugs per trap

**Oilseed rape:** a catch of 4 or more slugs per trap in standing cereals or 1 or more slugs per trap in cereal stubble
**Monitoring slug damage**

**Oilseed rape** crops should be monitored regularly for slug damage from sowing to the four true leaf stage when the crop is vulnerable.

**Winter cereal** crops should be regularly monitored from sowing to first tillering (GS21). Damage after this stage is less likely to result in further plant loss but monitoring should continue through winter.

**Potatoes** have two critical control periods (below), at 50% to 75% canopy closure and at the early stages of tuber bulking. Closely monitor slug activity during these periods, should control be necessary.

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**Cultural control**

**Cultivation**

Ploughing is a good way of reducing slug populations but even minimum tillage gives considerable reduction in slug damage compared to direct drilling.

**Seedbed preparation**

A fine, consolidated seedbed is important and will protect seeds and prevent slugs accessing seedlings before emergence.

Increase sowing depth of wheat to 4–5 cm if the seedbed is cloddy.

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**Biological control**

*Phasmarhabditis hermaphrodita* is a parasitic nematode that enters the slug’s shell sack (mantle), where it reproduces causing the mantle to burst. It usually takes between 7 and 21 days for an infected slug to die but its feeding is markedly reduced from the onset of infection. When the slug dies, the nematodes will continue to feed on it until the food source is depleted, before leaving in search of more slugs. Unlike pellets, nematodes can target soil-dwelling slugs, not only surface-active slugs.

Nematodes are best applied in dull weather, in the evening and before rain. They can be applied in advance of expected damage, at sowing or any time during the crop’s lifetime, however, success is dependent on wet conditions after application. In ideal conditions, nematodes will provide a reduction in damage for about six weeks after application.

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**Chemical control**

In cereals, seed treatment with the neonicotinoid clothianidin can help reduce seed kill, but not later seedling damage. Application of slug pellets should be integrated with cultural control measures associated with reducing risks.

**Metaldehyde**

Metaldehyde is a selective molluscicide and principally acts on slugs by inducing excessive secretion of mucous, leading to subsequent dehydration and death. At high temperatures of around 20°C the activity of metaldehyde is optimised; at low temperatures its toxic effect may be diminished. Metaldehyde does not harm predatory ground beetles, which can help to restrict slug populations.

**Methiocarb**

Methiocarb is most effective when ingested. It works at low temperatures (down to 2°C) which is of critical importance to controlling the problematic grey field slug, however, in some cases it has shown reduced control in these conditions. Methiocarb also provides a wide spectrum of control, being generally more effective against *Arion* species. It is best applied later in autumn, when ground beetles are less active.

**Ferric phosphate**

Ferric phosphate causes slugs to quickly stop feeding. They become less mobile and die within 3–6 days, often underground so evidence of dead slugs cannot always be seen.
Application method and timing

Broadcasting pellets is the best method of application and kills slugs more quickly than pellets that are drilled with seeds. It gives more consistent slug control, particularly in combination with fine, firm seedbeds that help protect seeds and seedlings.

Admixed pellets are ineffective in fine seedbeds because both seeds and pellets are unavailable to slugs, which survive to attack emerging seedlings.

Pellet admixtures with wheat seeds when direct drilling or in open cloddy seedbeds can be effective.

Critical control periods for potatoes:
1. 50% to 75% canopy closure, usually in late June to early July. The canopy is sufficiently open to allow pellet penetration.
2. Early stages of tuber bulking before slugs go underground to find developing tubers. August is the pivotal month for follow-up applications because slugs are still likely to be active under the canopy and tubers become attractive to slugs from September.

Application timing in wheat and oilseed rape

Broadcast slug pellets as soon as possible after drilling. Application is most effective up until the four true leaf stage in oilseed rape and GS14 in wheat.

Metaldehyde slug pellet stewardship

KILL SLUGS NOT METALDEHYDE

Metaldehyde is often detected in raw water above the drinking water standard, with peaks following rainfall. While levels detected pose no danger to health or the environment, the UK’s environment agencies and Defra are responsible for the implementation of the Water Framework Directive (WFD). Unless action is taken, regulatory restrictions, or even withdrawal, may be enforced.

What’s in Your Backyard?
Find out if you are in a Drinking Water Protected Area (DrWPA) or Safeguard Zone by entering your postcode into the Environment Agency’s online tool ‘What’s in Your Backyard’ www.wiyby.co.uk

Use WIYBY to create a targeted slug control programme that is up-to-date and tailored to your individual situation.

Application guidelines
- Use minimum active per hectare to avoid drainage and run-off losses.
- Maximum application rate: 210g metaldehyde a.s./ha*. For additional protection of water, BASIS-qualified suppliers or advisors may recommend rates reduced to 160g a.s./ha or less*.
- Maximum total dose from 1 August to 31 December: 210g metaldehyde a.s./ha*. For additional protection of water, BASIS-qualified suppliers or advisors may recommend rates reduced to 160g a.s./ha or less*.
- Maximum total dose rate: 700g metaldehyde a.s./ha/calendar year*.
- No pellets to be applied within 6 metres of a watercourse.
- Do not apply when heavy rain is forecast.
- If drains are flowing, do not apply metaldehyde-based slug pellets.

*from any combination of metaldehyde products. 700g is also the statutory limit. a.s. = active substance (or active ingredient)

Further information
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www.ahdb.org.uk/slugcontrol

www.hgca.com/pests
www.potato.org.uk/slugs

The Metaldehyde Stewardship Group www.getpelletwise.com

What’s in Your Backyard?
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