Section 5 – Physical controls

Overview

Physical controls are best applied over summer and autumn to kill snails and make their habitat less favourable. Strategies include:

- weed control;
- cabling or chaining;
- rolling;
- burning or windrow burning;
- cutting or slashing; and
- grazing.

Physical controls are most effective against round snails, and any snails sheltering on stubble (Box 5.1). Weed control limits survival of all species. As part of integrated control, taking opportunities to drive snail populations down between cropping seasons reduces infestations in the following crop or pasture. Select control methods compatible with your farming operation (Table 5.1).

Weed control

Green weeds provide moist refuges for snails in summer (Figure 5.2). Green weeds can increase snail survival in summer by 50 per cent[6,7] and reduce the efficacy of burning by 40 per cent[8]. Weeds should be desiccated before undertaking other physical controls. Snails harbour in *Brassica* spp weeds[2,6,7], horehound (*Marrubium vulgare*)[2,6,7], onion weed (*Asphodelus fistulosus*) and other green weeds.

BOX 5.1: EXPLOITING SNAIL BEHAVIOUR FOR CONTROL IN SUMMER

- Snails aestivate in summer to avoid moisture loss and heat extremes. They commonly aggregate in clusters attached to objects above ground or under refuges on the ground.
- Conical snails are more likely to shelter under rocks and weeds, in the soil around plant roots, and inside the stalks of canola stubble (Figure 5.1).
- There is high natural mortality of snails during hotter summers and heatwaves[1–3]. In summer, snails have an innate climbing reflex, which causes them to climb onto the nearest resting site immediately after being dislodged[4].
- Cabling, chaining, cutting and grazing stubble in summer dislodges snails and forces them to move across hot soil, killing them or depleting their energy reserves.
- Temperatures of about 60°C kill round and conical snails instantly[5]. On sunny days with ambient temperatures near 40°C, temperatures can be 60°C to 70°C on the ground, but may be 10°C to 15°C cooler at the top of 15cm stubble where snails can rest[1].

Figure 5.1: Snails resting above ground to avoid high ground temperatures.

Images: Kym Perry

Table 5.1: Key actions.

Actions	Considerations
Summer (after harvest)	
Monitor to assess options for summer control	• Choose control options that are compatible with your farming operation
Control summer weeds before undertaking other controls	• Removing weedy snail refuges reduces snail survival in summer and increases the efficacy of other controls
Cable or chain stubble on hot days to kill snails	• Most effective early in summer when there are fewer green weeds • Cable on hot, sunny days when ambient temperature exceeds 35°C and ground temperature exceeds 50°C • Use two passes, at least one hour apart; avoid smashing sensitive stubbles (for example, lentils) to minimise erosion risk • Manage fire risk by threading cables with polythene pipe • Determine the Fire Behaviour Index. • Less effective on conical snails
Roll stubble to crush snails and remove refuge sites	• Heavy flat steel rollers are more effective than rubber-tyred or steel-ribbed rollers • Effective from summer to autumn when snails are resting on stubble • Less effective on conical snails
Consider cutting or slashing stubble shorter to kill snails and remove refuges	• A second pass with the harvester or slashing, when snails are resting on stubble, kills some snails • Shortening stubble exposes snails to hotter ground temperatures in summer • Determine the Fire Behaviour Index.
Consider grazing stubble to dislodge and crush snails	• The impact of grazing in suppressing snail populations depends on stock density and movement
Autumn (before crop sowing)	
Consider burning stubble to kill snails and manage stubble	• A hot, even burn can achieve high snail kill • Kill green weeds, turn over rocks, and roll stubble flat before burning • Consider soil health and erosion risk • Burning canola windrows after harvest can reduce snail numbers while reducing impact on soil health

Cabling

Cabling can be used to knock snails from stubble during hot weather, exposing them to ground temperatures that can kill them. Rocks are also turned over by cabling, which exposes conical snails to heat. Cabling is carried out using a cable of 3 to 5cm diameter, such as a punt cable, strung between two tractors or vehicles driven up to 300m apart (Figure 5.3). A 20 to 25mm diameter chain can also be used. A chain is more aggressive on stubble but turns over more rocks. At the end of each cable, a short length of 0.5cm diameter chain should be inserted as a safety break point. Always maintain radio communication between vehicles.

Cabling is rapid, with 120 hectares per hour (ha/hr) covered using a 150m cable. Repeat passes are possible on the same day. Cabling is best performed on hot, sunny days when ambient temperatures exceed 35°C and ground temperatures exceed 50°C. A laser thermometer can be used to measure ground temperature. Up to 70 per cent kill can be achieved with one pass in suitable conditions[8]. A higher kill rate can be achieved using two passes at least one hour apart. This allows time for dislodged snails that survive the first pass to re-climb the stubble before the second pass.

Cabling can miss fencelines where snail numbers may be higher. Consider the need for internal fencelines if not required for stock. Flat steel rollers can also be used for border passes. Cabling, especially with a chain, can pull out plants by the roots and leave soil susceptible to erosion. Excessively smashing sensitive crop stubbles, such as lentils, can also lead to erosion of lighter soils. Take care to avoid obstacles such as trees or stone heaps.

Fire risk from cabling is minimal but higher in areas with iron stone rocks or when cabling near steel posts. Fire risk can be reduced by threading polythene pipe over the cable. Before cabling, monitor and determine the Fire Behaviour Index.

Figure 5.2: Green weeds provide moisture and shelter for snails in summer.



Images: Kym Perry

Figure 5.3: Cabling or chaining.



Images: Emma Leonard

Rolling

Flat steel, steel-ribbed or rubber-tyred rollers can be used to flatten stubble, which crushes some snails and removes above-ground resting sites (Figure 5.4). Flat steel rollers are most effective for crushing snails, while steel-ribbed rollers help crush rocks. Rolling can cause 50 to 90 per cent snail mortality[8], but is less effective on conical snails.

One pass is generally sufficient to flatten wheat, but two passes in opposite directions may be needed to snap flexible barley stalks. Any upright stems remaining after rolling can provide snail resting sites, reducing effectiveness. If using a disc seeder, rolling in the same direction as seeding can reduce hair-pinning.

Rolling is effective from summer to autumn when snails are resting on stubble. About 15ha/hr can be rolled using a 15m wide triple-section roller (Figure 5.5).

Burning

Burning stubble is an effective control method for round and conical snails. A hot, even burn is important for good control, as poor kill is achieved in unburnt patches (Figure 5.6). Rolling stubble flat first can assist in achieving a thorough burn across the entire paddock.

Snails shelter under rocks and on summer weeds. Rocks should be turned over immediately before burning, by cabling or fire harrowing, and summer weeds should be desiccated. Burning after desiccating summer weeds can reduce numbers of round and conical snails by 95 per cent, but up to 40 per cent survival can occur where green weeds protect snails from fire (Figure 5.6).

Burning has positive and negative agronomic impacts to consider. It can destroy stubble-borne diseases and weed seeds, but reduces soil organic matter and kills soil organisms, with detrimental effects on soil health and crop production[8,10]. Burning is often incompatible with modern farming practices but can be used in some regions to manage excessive stubble loads prior to seeding. Avoid burning in areas prone to soil erosion.

Figure 5.4: a) Flat steel, b) and c) steel-ribbed and d) rubber-tyred rollers.

a) b) c) d)

Images: Kym Perry

Figure 5.5: Triple-section flat steel roller, weighing up to 11 tonnes per section when filled with water.

Image: Nicole Fechner

Windrow burning

Burning windrows created from canola stubble can kill snails and reduce impacts on soil health compared to whole paddock burning (Figure 5.7). In one trial in Western Australia, burning canola windrows reduced the total numbers of small pointed snails by 90 per cent[11]. Movement of snails into windrows, and potential kill rates from burning them, can increase where inter-rows have minimal shelter, such as fallen stubble or weeds[11]. Inter-rows can be rolled to remove tall resting sites. The longer that windrows sit on the ground, the more opportunity snails have to move into windrows before burning.

Cutting stubble lower

Stubble can be cut lower using a second pass with the harvester or a slasher. This can be useful where a stripper front harvester, or higher cutting height, was used to reduce harvest intake of snails, leaving more standing straw. Cutting or slashing flicks snails to the ground and crushes some of them. Dislodged snails can re-climb the remaining shorter stalks but are exposed to hotter temperatures near the ground in summer[1]. Using a 4m slasher is slow, covering about 4ha/hr[8]. Take care in stony paddocks to avoid sparking a fire. Always monitor and determine the Fire Behaviour Index[9].

Grazing

Grazing animals knock snails from stubble and may incidentally trample and consume them (Figure 5.8). Snail mortality from grazing is dependent on stock density and movement. A 32 per cent reduction in snail numbers was recorded in lentil stubble[8]. Grazing is less effective than cabling or rolling, but can contribute to integrated snail management in mixed cropping programs.

Figure 5.6: a) High control of round and conical snails is possible with a hot, even burn[8].
b) Desiccating summer weeds prior to burning substantially increases snail kill (data for conical snails)[8].

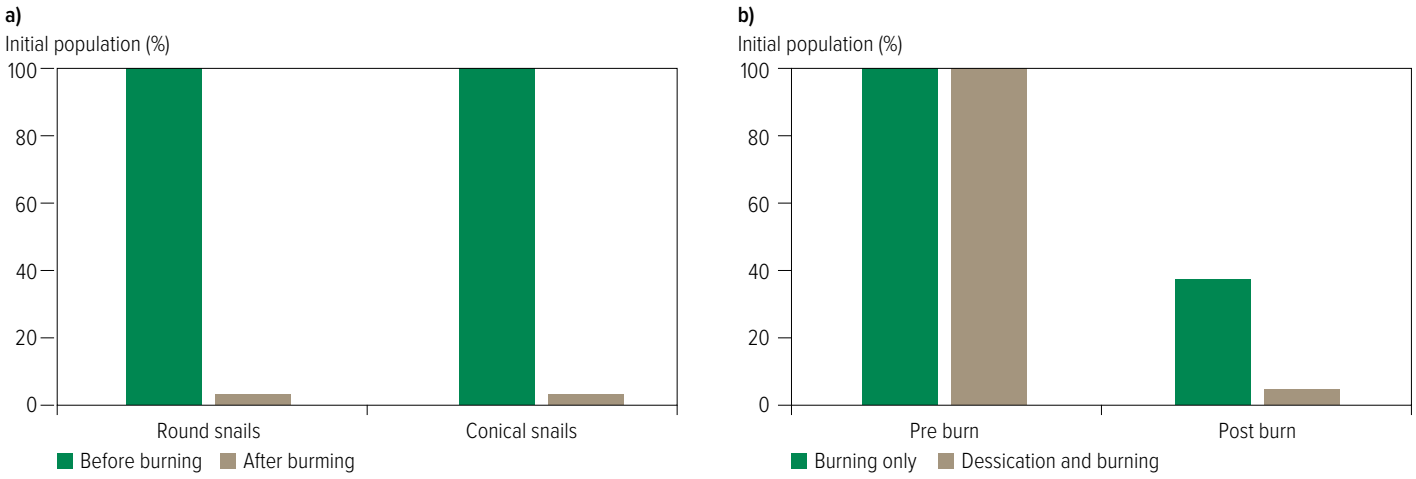

Figure 5.7: Windrow burning canola stubble.

Image: Austockphoto / Jane Worner

Figure 5.8: Grazing animals can trample, dislodge or consume snails.

Image: Emma Leonard

References

1. Perry, K.D., Brodie, H., Muirhead, K.A., 2020. New methods for snail control (UOA1903-014BLX). Final report for GRDC. South Australian Research and Development Institute.

2. Baker, G.H. and Hawke, B.G., 1990. Life history and population dynamics of *Theba pisana* (Mollusca: Helicidae) in a cereal-pasture rotation. *Journal of Applied Ecology*, pp. 16-29. https://doi.org/10.2307/2403565

3. Muirhead, K.A. and Perry, K.D., 2021. Biocontrol of invasive conical snails by the parasitoid fly *Sarcophaga villeneuveana* in South Australia 20 years after release. *Insects*, 12(10), p. 865. https://doi.org/10.3390/insects12100865

4. Aubry, S., Labaune, C., Magnin, F., Roche, P. and Kiss, L., 2006. Active and passive dispersal of an invading land snail in Mediterranean France. *Journal of Animal Ecology*, pp. 802-813. https://doi.org/10.1111/j.1365-2656.2006.01100.x

5. Cassells, J., Banks, H., and Annis, P., 1994. Mortality of snails *Cernuella virgata* and *Cochlicella acuta*, exposed to fumigants, controlled atmospheres or heat disinfestation. In *Proceedings of the 6th International Working Conference on Stored-product Protection*, pp. 50-55 (1994).

6. Baker, G.H. and Vogelzang, B.K., 1988. Life history, population dynamics and polymorphism of *Theba pisana* (Mollusca: Helicidae) in Australia. *Journal of Applied Ecology*, pp. 867-887. https://doi.org/10.2307/2403752

7. Baker, G.H., 1988. The life history, population dynamics and polymorphism of *Cernuella virgata* (Mollusca, Helicidae). *Australian Journal of Zoology*, 36(5), pp. 497-512. https://doi.org/10.1071/zo9880497

8. Leonard, E., Baker, G.H., and Hopkins, D.C., 2003. *Bash Em Burn Em Bait Em: Integrated snail management in crops and pastures.* South Australian Research and Development Institute. URL: https://grdc.com.au/resources-and-publications/all-publications/publications/2003/12/bashem-burnem-baitem-integrated-snail-management-in-crops-and-pastures

9. CFS Grain Harvesting Code of Practice, 2022. URL: https://www.cfs.sa.gov.au/plan-prepare/business-farms/farm-fire-safety-prevention/

10. Mckenzie, N., Jacquier, D., Isbell, R. and Brown, K, 2004. Australian soils and landscapes: An illustrated compendium. CSIRO Publishing. https://doi.org/10.1071/9780643100732

11. Micic, S., Dore, T., and Wahlsten, L., 2016. When to burn and when not to burn: Burning as a tool for snail control (project code: DAW00251). GRDC Updates Paper. Department of Primary Industries and Regional Development. https://www.farmtrials.com.au/trial/18237