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FACT SHEET | AUGUST 2025

Integrated pest management: Thresholds guide and beneficials

What is a threshold?

A threshold is a critical level of pest infestation at which control measures should be initiated to prevent the pest population from reaching economically damaging levels. A threshold will vary based on a combination of factors, including the type of crop, the specific pest species, the growth stage of the crop, weather conditions and the economic impact of pest damage.

Threshold levels are based on field observations and local experience. These thresholds are usually expressed as the number of pests, their growth stages, or the extent of damage that can be tolerated before action is required and will vary between crops, pests and growing regions.

KEY MESSAGES

- Establish a threshold by collecting baseline data on environmental factors, pest life cycle and crop growth stages.
- Monitor for pests and beneficials to establish and use your thresholds.
- Know the life cycle of beneficials and pest species when monitoring and deciding on the course of action. Remember to consider temperature, as this affects the development rate.
- Consider various approaches to support beneficials on your farm, including 'doing nothing' and banker plants to host beneficial species that suit your vegetable production system.

Hort Innovation

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Establishing thresholds

Establishing baseline data for your thresholds is an ongoing process that requires continuous monitoring, data collection and analysis. By systematically documenting pest dynamics and crop conditions, growers or their integrated pest management (IPM) advisers can make informed decisions to manage pests effectively.

- **Identify, understand, record and monitor pest and beneficial populations** that affect the crop, including life cycles, behaviour and population dynamics. When monitoring, record data on abundance and distribution over time. When starting out, consult with an experienced entomologist or crop scout.
- **Determine the economic threshold** or the point when the cost of potential damage outweighs the cost of control measures. This is dependent on crop type and growth stage, pest species and the current market value.
- **Keep a record of pest outbreaks**, their origin, abundance, associated crop damage and the control measures used.
- **Document management practices** such as crop rotation, tillage, irrigation, spray regimes and planting dates. These practices can affect pest populations and should be considered when establishing thresholds.
- **Record environmental factors** such as temperature, humidity, rainfall and soil moisture. These factors can influence the population dynamics of pests and beneficials and should be considered when planning pest control actions.
- **Analyse the collected data** to identify patterns and trends in pest populations, crop damage and environmental conditions. This information forms the basis of thresholds that trigger pest management interventions such as the release of beneficials. Over the long term, this data can be used to assess the effectiveness of your IPM strategy.
- **Consult with other growers and advisors in the region.** They can provide additional information on setting thresholds based on local conditions and best practices. Additionally, consider engaging with an IPM consultant or entomologist to advise on your thresholds or pest problems.

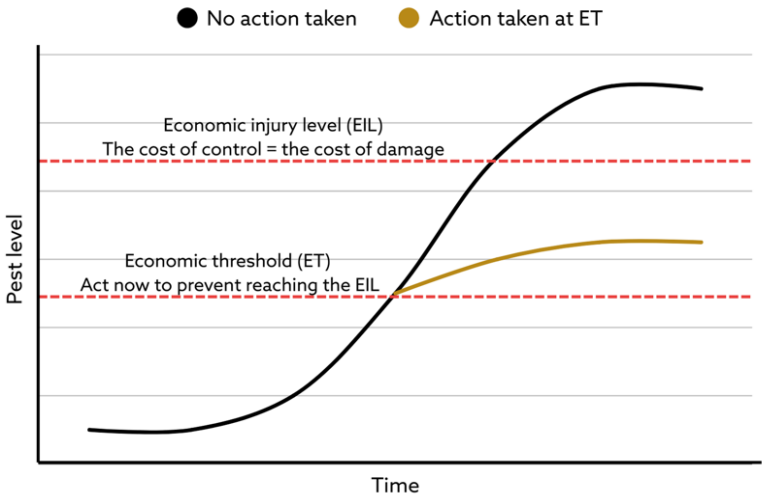

Figure 1: Pest population over time and when to take action, the economic threshold (ET), before the population reaches a level where the cost of damage equals the cost of the control, referred to as the economic injury level (EIL). If action is taken at the ET, the EIL is avoided.

Why is it important to monitor pest and beneficial insect populations?

Monitoring pest and beneficial insect populations in your crop is the cornerstone of IPM, as it is used to determine control strategies. Knowing what your pests and beneficials are doing informs how and when to act and when to do nothing. Figure 2 shows a hierarchy of action in IPM relative to the increasing level of toxicity and intervention. A good IPM plan is based on creating an environment hostile to pests but that promotes healthy plants and beneficials and only uses chemical control strategically, as pesticides can have unintended consequences on your wider IPM plan. Before resorting to chemicals, biological control is a feasible and effective measure when used in conjunction with cultural controls such as a good monitoring program and defined thresholds. When using beneficials as a biological control, consider the lag phase until beneficial populations increase to a level where they provide effective pest control.

Establishing a monitoring plan

Monitoring is a key step in establishing and actioning thresholds. It should be quick and efficient, and done regularly. Importantly, for good data collection, it must be systematic, with random sampling points within each sampling unit.

- **Map your field**, including crop type, plant density, development stage and planting dates. This will be important to understand the impact of pests on your crop.
- **Decide how you will sample**. There are many different methods to sample for pests and beneficials (see further resources on p.7), each with pros and cons and better suited to certain bugs. Determining what you are monitoring and how much time to commit to monitoring will help determine your methods.

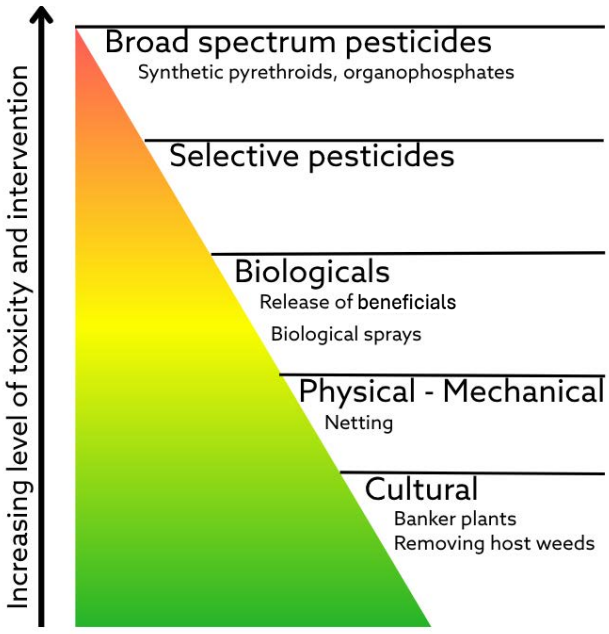

Figure 2: Hierarchy of action in integrated pest management. Most of the work should be at the bottom of the triangle (adapted from Lowe et al, 2019).

- **Determine your monitoring frequency.** This depends on your available time, local pest pressures and the season. Monitoring should be more frequent in autumn and spring when pests are most active (around once a week) and less in the peak of summer and winter.
- **Determine your sampling pattern**. This will depend on your production system, crop type, local pest pressures and season, but you'll want to divide the production area into smaller areas or 'sampling units'. These units could be a row, a greenhouse or a paddock, as long as it makes sense to you and is convenient. For accurate data, it's important to maintain the same sampling units over time. Once you have your sampling unit, take a random sample every couple of meters (sampling points, as shown in Figure 3) and avoid sick plants, as they can bias your sample (but check them for pests). You'll want at least three sampling points per sampling unit, but include more sampling points for large sampling units.
- **Collect, record and analyse your data** by counting and recording each species within each of your sample points and use this to calculate the average for each sampling unit. Pests that occur in high numbers, such as aphids, can be recorded as present or absent to save time, especially for heavy infestations. This data is used as the basis of your thresholds.

Using your thresholds

Preventing pests from reaching threshold levels

Creating an environment that is hostile to pests but supports beneficials is an important part of IPM. This cultural control starts with keeping your plants healthy and supporting the beneficials already on the farm. Importantly, this sometimes means having low levels of pests present to support beneficials, as they are often a food source (e.g. for lacewings, ladybeetles) or egg-laying site (e.g. for parasitoid wasps). Having a good monitoring routine, inclusive of pests and beneficials, helps

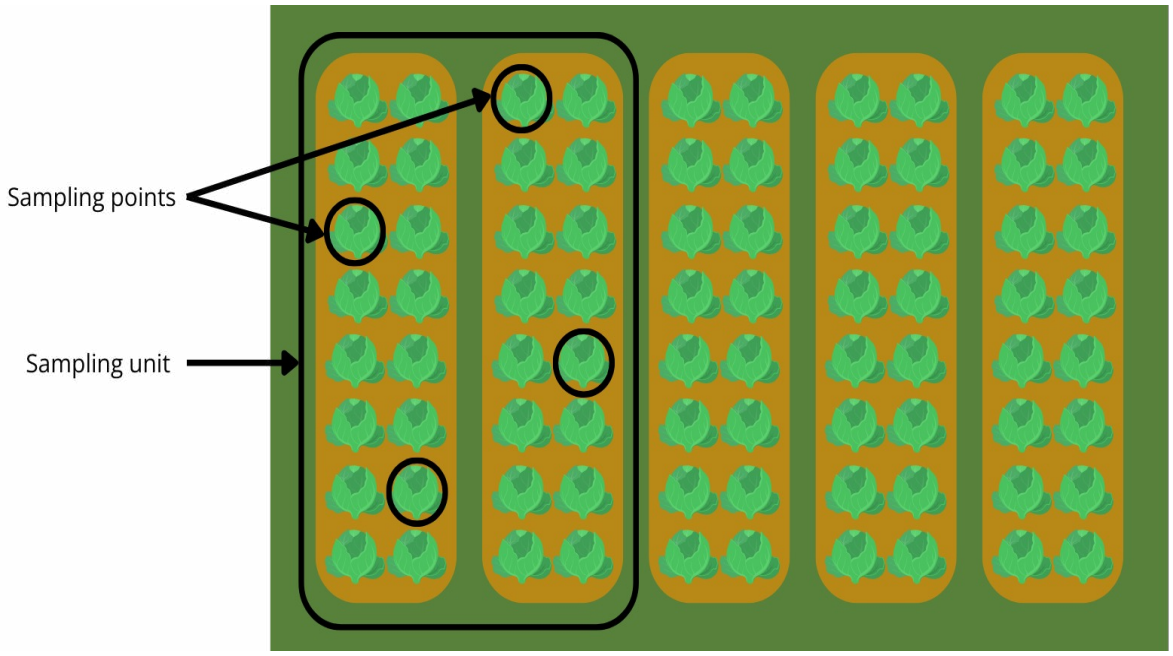

Figure 3: Example of a sampling pattern. A sampling unit is the area where you take your sample points. Your sample unit should stay the same, but your sampling points should be chosen randomly within the sampling unit.

inform if action is required. Taking no action when pests are below your threshold level gives beneficials a chance to do their job and build in numbers (Figure 4).

Tips for preventing pest build-up and supporting beneficials

- **Use insecticides and miticides sparingly and wisely**. Use these only when economic damage to your crop is imminent, and select 'softer' pesticides that are targeted to your pest only. Apply them in hotspot areas where pests are concentrated and always follow label instructions. See beneficial toxicity table (further resources on p.7) for information on 'softer' pesticide recommendations.
- **Use non-persistent, non-systemic, selective pesticides** and avoid broad-spectrum and systemic products. Broad-spectrum products, such as organophosphates and pyrethroids, kill many different invertebrates including beneficials, and leave residuals that kill long after application. Systemic products such as neonicotinoids enter the plant and poison beneficials that eat its nectar and pollen. This reduces your beneficial population over time and can increase your pest pressures.
- **Grow banker plants** or plants that attract and provide a habitat for beneficials. They will help attract new beneficials to your field and provide shelter, food and water for existing ones.
- **Control weeds** that are known hosts for pest species, especially during the pest's active season.

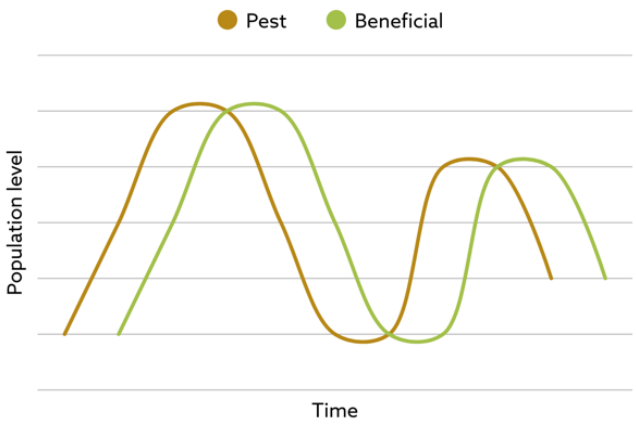

Figure 4: Pest (brown line) and beneficial (green line) population dynamics over time. There can be a delay in beneficial population build-up, as beneficials use pests for food or for reproduction. This is why it's sometimes best to do nothing and why monitoring and solid thresholds are important in determining your action plan.

Optimising release of beneficials when thresholds are met

The timing of beneficial insect release will depend on the life cycle and breeding rate, how many pests the beneficial insects can consume, the baseline pest population and the crop growth stage. You must also consider the life stage of the pest you are targeting, correctly identify the pest and match it with the appropriate beneficial.

Consider the following to optimise the release of beneficials.

- **Beneficial release isn't an instant fix**. They are most effective when released before economic damage is imminent. Timing is dependent on the beneficial and weather conditions, but releasing a couple of weeks before the economic threshold is reached ensures the best results. Having a solid monitoring program and understanding of your farm's thresholds is essential to optimise the release of beneficials for pest control.

- **Accurately identify your pest** and its predator. Just like using insecticides, choosing the right bug for the job is essential for control. Ladybeetles won't eat caterpillars, and an aphid parasitoid won't control thrips, no matter how many you release.
- **Release when the pest's vulnerable life stage is present**. This is dependent on your pest and beneficials being used. Some beneficials target eggs, while others target juvenile stages or adults. Matching the beneficial to the pest life stage, and ensuring the pest is present in that stage, is key.
- **Protect your beneficials from harm** by releasing them either early in the morning or at night to avoid extreme temperatures. Avoid releasing beneficials when pesticides have been applied or in areas where systemic or residual products have been applied.
- **Provide a habitat for your beneficials** by planting banker plants. This will provide them with shelter, water and a place to reproduce. This will also help carry over the beneficials, and help build up their populations over time, reducing the need to release them in the future.

Risks and challenges

- **Inadequate monitoring** – this can lead to delayed responses and ineffective pest management.
- **Incorrect pest identification** – it is important to be accurate with pest identification to implement to most effective control methods.
- **Inaccurate thresholds** – regularly review and update thresholds on changing weather conditions and pest population dynamics.
- **Pesticide resistance** – when pesticides are used as part of an IPM program, there is a risk of pests developing resistance to the chemical over time which reduces the efficacy of the chemical controls. It is important therefore to not only rely on one group of chemicals but look at using a combination of different modes of action chemical groups.

Seek expert advice

- **Seek advice** from local IPM experts, entomologists and/or biological control experts who can provide insights into the specific requirements for successful beneficial insect release in your region.
- To find the most up to date information on IPM thresholds for vegetable crops in Australia **check reputable sources** such as research institutions, universities and other agricultural research organisations, online resources and consulting with experts, as IPM practices and recommendations can evolve over time.

FURTHER RESOURCES

Integrated pest management

1. Mega Pests: The basics of protecting your crops (Soil Wealth ICP, 2024) soilwealth.com.au/wp-content/uploads/2024/05/Mega-Pests_Basics-of-protecting-your-crops_20240515.pdf
2. Mega Pests: Managing major chewing and biting insects (Soil Wealth ICP, 2024) soilwealth.com.au/2024/04/mega-pests-managing-major-chewing-and-biting-insects/
3. Mega Pests: Managing sucking pests (Soil Wealth ICP, 2023) soilwealth.com.au/2023/10/mega-pests-managing-sucking-pests/
4. Webinar: Adopting IPM – principles and practices (Soil Wealth ICP, 2024) soilwealth.com.au/2024/09/ipm-webinar/

Ute guides for pests and beneficials

5. Pest, diseases and disorders of cucurbits: A field identification guide (Soil Wealth ICP, 2024) soilwealth.com.au/2024/05/cucurbit-ute-guide/
6. Pests, diseases and disorders of brassica vegetables: A field identification guide (Soil Wealth ICP, 2023) soilwealth.com.au/2023/07/pests-diseases-and-disorders-of-brassica-vegetables-a-field-identification-guide-revised-2023/
7. Pests, diseases and disorders of carrots, celery and parsley: A field identification guide (Soil Wealth ICP, 2023) soilwealth.com.au/2023/07/pests-diseases-and-disorders-of-carrots-celery-and-parsley-a-field-identification-guide/
8. Pests, diseases and disorders of baby leaf vegetables: A field identification guide (Soil Wealth ICP, 2023) soilwealth.com.au/2023/07/pests-diseases-and-disorders-of-babyleaf-vegetables-a-field-identification-guide-revised-2023/
9. Pests, diseases and disorders of sweet corn: A field identification guide (Soil Wealth ICP, 2023) soilwealth.com.au/2023/07/pests-diseases-and-disorders-of-sweet-corn-a-field-identification-guide-revised-2023/

Promoting beneficials

10. How does the surrounding landscape affect beneficials on your farm? (Hort Innovation, 2020) horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/grower-resources/vg16062-assets/How-does-the-surrounding-landscape-affect-beneficials-on-your-farm/

11. Revegetation by design: A guide to using selected native plants to reduce pests and diseases in the horticulture region of the Northern Adelaide Plains (Taverner et al., 2006) ausveg.com.au/app/data/technical-insights/docs/reveg_by_design_guidebook.pdf

Selecting 'soft' pesticides

12. Pesticide effect on beneficials in vegetable crops (Soil Wealth ICP, 2020) soilwealth.com.au/2020/08/guides-pesticide-effects-on-beneficials-in-vegetable-crops/

13. Beneficials chemical toxicity table: Impacts of insecticides on beneficial insects in Australian grain crops (Cesar Australia, 2024). (Note, some pesticides used in grain crops aren't registered for horticulture) cesaraustralia.com/wp-content/uploads/2023/05/CesarAustralia_ToxicityTable_April2024.pdf

Monitoring techniques

14. Monitoring for pests and beneficials (The Beatsheet) thebeatsheet.com.au/key-pests/monitoring-for-pests-and-beneficials/

15. Monitoring tools and techniques (IPM Guidelines for Grains) ipmguidelinesforgrains.com.au/ipm-information/making-informed-control-decisions/monitoring/monitoring-tools-and-techniques/