

**NZ Plant Producers**

# PLANT PRODUCTION SCIENCE

**Bringing you the latest plant science  
from New Zealand and around the world.**

**ISSUE 6**  
DECEMBER 2025

**In Issue six we look at Weed Management  
and Environmental Pest Plants.**

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## Integrated weed management in nurseries

Weed management is one of the most time-consuming and costly challenges in nursery production.

While herbicides are widely used, relying on chemical control alone is unlikely to produce consistent results. An integrated approach that combines sanitation, physical control, and chemical tools can help long-term success.

Recent research shows that prevention is just as important as treatment. Clean pots, weed-free propagation material, and careful fertiliser placement can significantly reduce the conditions that allow weeds to thrive. Placing controlled-release fertiliser several centimetres below the substrate surface, for example, limits nutrient access for weeds like liverwort and oxalis. Stratified potting media, with coarser substrates at the pot surface, or use of mulches, can also reduce the presence of liverwort and make weeding easier.

Hand weeding remains a key component of any effective strategy. Fast-cycling species like bittercress (*Cardamine hirsuta*) and willowherb (*Epilobium spp*) must be removed before they flower and set seed, which can occur just three to four weeks after germination. A two-week weeding cycle has been shown to be more effective and efficient than less frequent interventions.

Pre-emergent herbicides can help reduce manual weeding, especially when applied accurately and evenly. They can also be used on paths and surrounding areas to reduce external seed sources that contribute to nursery infestations.



An integrated approach that combines sanitation, physical control, and chemical tools can help long-term success.

As many nurseries face seasonal staff shortages and rising labour costs, adopting a proactive, layered weed management plan is more important than ever. Get in touch with ICL for free on-site training and practical resources on management systems to reduce weed pressure and protect crop-quality.

See page 13 for a pull-out checklist that you can use in your nursery.

# Controlling ballistic weeds

Weeds with explosive seed capsules are a continuous pressure in plant production. Their ability to mature quickly and project seed across short distances allows them to move efficiently through container layouts.

Effective management relies on interrupting this cycle before seed release. Frequent scouting, a clean growing environment and well-timed applications of suitable pre-emergent herbicides remain central to long-term suppression of these highly mobile weeds.

Two of the main culprits are creeping oxalis and bittercress species.

Creeping oxalis (*Oxalis corniculata*) is one of the most persistent species in nurseries. It spreads through both vegetative stolons and seed. Thin horizontal stems root wherever they contact moist substrate, forming a low mat that moves across pot rims and bench surfaces. *O. corniculata* occurs in several colour forms, including green, bronze, and deep purple. The species

Effective management relies on removing plants before seed maturation.



Creeping oxalis (*Oxalis corniculata*). Photo credit: Trevor James



Hairy bittercress (*Cardamine hirsuta*). Photo credit: Trevor James

reaches reproductive maturity quickly. Under warm and irrigated nursery conditions, flowering usually begins 3 to 5 weeks after emergence, with cooler conditions extending this to 6 to 8 weeks.

The small yellow flowers develop into elongated capsules that dry under tension. As the capsule matures, the outer tissues contract and the inner layer coils, releasing seeds with force when the

capsule splits. Capsules typically reach the explosive stage 10 to 14 days after flowering and contain 6 to 12 seeds. Most seeds fall within 30 to 50cm of the parent plant, although distances of up to 2 metres have been recorded under ideal drying conditions. Plants flower repeatedly through the season, so multiple generations can form, increasing the importance of early detection.

Bittercress species (*Cardamine* spp.) show a similar pattern of rapid growth and effective seed dispersal. The genus belongs to the Brassicaceae family, and the characteristic silique is central to its success as a weed. As siliques mature, the two outer valves dry and coil. Even slight disturbance, including irrigation or pot handling, can trigger splitting and eject seeds.

Hairy bittercress (*Cardamine hirsuta*) and wavy bittercress (*C. flexuosa*) are the species most often encountered in container production. Seedlings form a compact basal rosette and flower after 3 to 4 weeks in warm periods, or 5 to 6 weeks in cooler conditions. Seed set follows soon after the vertical flower stalks appear. Each pod usually contains 10 to 30 seeds, and dispersal distances of up to 1.8 metres have been documented. Pods reach explosive maturity 7 to 14 days after flowering, which leaves a narrow window for control.

The native species, *Cardamine corymbosa* also occurs in nurseries. It is smaller than hairy bittercress, with leaves held close to the substrate, and spreads through short stems that root at contact points. It is deeper rooted than the other species, making manual control more difficult. Once it flowers, it is easily distinguished from other bittercresses. Flowers occur singly on fine basal stalks that tend to lean sideways. Petal number varies from one to four, sometimes within the same plant. Pods contain 8 to 20 seeds which are dispersed by ballistic projection, spread through water movement and attach to containers, tools and footwear.



*Cardamine corymbosa*.

Photo credit: Peter B. Heenan

The native species *Cardamine corymbosa* has also found its way overseas. The earliest verified record comes from the rock garden of the Royal Botanic Garden Edinburgh in 1975. Soil and small seeds lodge easily in the tread of footwear and Botanic gardens, which receive high visitor traffic from many countries, are frequent first points of establishment for species that travel in this way. By the 1990s and 2000s it had become a routine contaminant of nurseries and gardens throughout the British Isles and was recorded more widely across Europe. In the United States, it was confirmed in a container nursery in Wilkes County, North Carolina in 2009. The infestation was traced to a wholesale nursery in Washington County, Oregon, and further populations were found in Clackamas County, Oregon. These findings show that once the species enters commercial pathways, container stock provides an efficient means of spread within horticultural networks.

# Wind-blown weeds

Windblown weeds are built for travel. Their seeds are light, built with fine hairs that carry them adrift. They settle on potting media, in small gaps on hardstand areas or on the edges of containers and germinate quickly on wet surfaces. This is why they appear even in areas that have been cleaned only days earlier.

Recent research shows that windblown weeds produce far more seed than most growers expect. Monitoring in open nurseries found that willowherb (*Epilobium ciliatum*) and fleabane (*Erigeron bonariensis*) produce heavier seed rain than explosive weeds such as creeping oxalis and bittercress and can contribute far more seed per day during peak periods.

Sowthistle (*Sonchus oleraceus*) and groundsel (*Senecio*) also behave in this way and can occasionally pop up in containers. The key problem for growers is the steady

input of seed from outside the nursery. It takes only a small number of seeds landing on an exposed surface to trigger a new round of germination.

Evidence from seed-trap studies has shown that in many nurseries, more than half of the incoming seed comes from outside the nursery boundary, from upwind roadsides, fields and shelterbelts, and unmanaged corners around the boundary. This means that a clean production area will only stay clean if the boundary is managed with the same level of care as the container blocks.

Windblown weeds also release seed for far longer than expected. Groundsel and fleabane do not produce a single flush. They continue forming new buds and flowers while older heads are releasing seed, so that a single plant can produce seed for several weeks. This means a single surviving plant on the boundary can supply new seed through the entire season.

Another surprising finding is how little seed is needed to re-establish a problem. Recent work in container systems shows that even ten to twenty seeds per square metre can lead to noticeable infestations within weeks, because germination is high on moist pot surfaces.



Willowherb (*Epilobium ciliatum*)



(L) Broad-leaved fleabane (*Erigeron sumatrensis*) and (R) Wavy-leaved fleabane (*E. bonariensis*)



Sowthistle (*Sonchus oleraceus*)

The biggest predictor of infestation is air movement patterns. Trials mapping seed deposition found airflow patterns inside the nursery, including through shade structures, have a strong effect on seed distribution. Some blocks can receive two or three times more seed than others, regardless of sanitation.

These findings show that managing the upwind boundary is often as important as maintaining clean pots and benches.

Each species brings its own behaviour. Fleabane produces a tall central stem with many side branches and can reach flowering within six to eight weeks. The lower flower heads release seed while new buds continue forming at the top.

Willowherb can begin flowering within four to six weeks, producing narrow seed capsules filled with light seeds which mature in ten to fourteen days. They flower continuously along the stem, creating a steady supply of seed. A native willowherb, *Epilobium nummulariifolium*, is also a problem in some nurseries. It forms a low creeping mat that roots at the nodes where stems touch the surface, allowing it to spread across trays and between containers, in addition to spread through its wind-borne seed.



Groundsel (*Senecio vulgaris*)



Native willowherb (*Epilobium nummulariifolium*)

Sowthistle forms a basal rosette and then sends up a hollow stem with yellow flowers. It branches freely and the flower heads mature in sequence. It completes its life cycle in about six weeks in warm conditions. Groundsel grows fast in nursery conditions. Seedlings establish within a few days on moist surfaces, and plants can begin flowering four to six weeks after germination in warm periods. The seed heads mature quickly, often within 10 to 14 days of flowering, so a full cycle from seed to fresh seed release can occur in six to eight weeks, with multiple generations possible in one season.

As with explosive weed species, stopping seed production is central to long-term control. Windblown weeds will always arrive. The goal is to reduce how many survive long enough to flower and set seed.

## Managing liverwort

Liverworts take hold in shaded, damp parts of a nursery and spread across media surfaces in thin green sheets. Their waxy surface repels water, and heavy infestations can smother seedlings and lower survival rates.

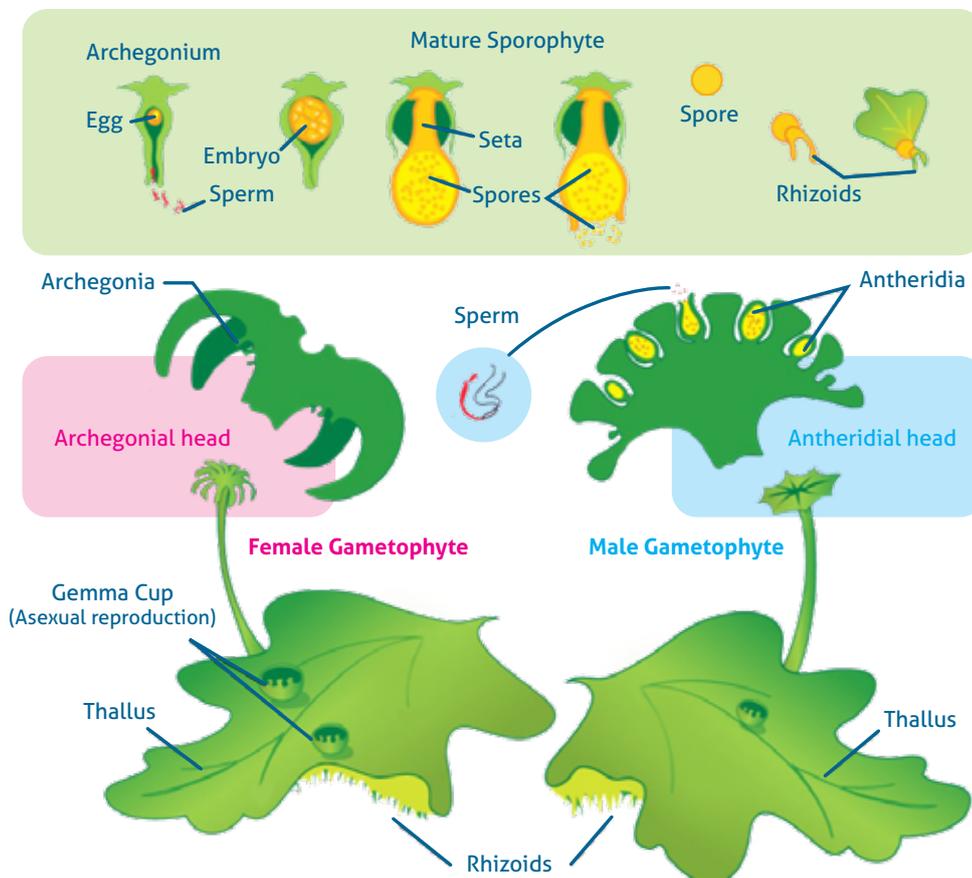
Marchantia species are the most common liverworts in nurseries. They grow as flat, branching thalli and absorb water and nutrients across their entire surface. Liverworts prefer cool temperatures, low UV light, high humidity, moist substrates and high nitrogen and phosphorus availability, conditions which are common in propagation and production areas.

Their biology gives them an advantage in container systems because they thrive on wet media and reproduce through spores and gemmae that move easily in irrigation. Once established, they grow quickly and form dense mats that reduce aeration and water penetration, limit moisture reaching plant roots and compete directly with young plants. Liverworts also use nutrients quickly, especially in fertigation systems, which can reduce the uniformity and vigour of young plants.



Marchantia

### Liverwort Life Cycle



This diagram shows the two main stages of the liverwort life cycle. The green thallus is the gametophyte stage, which produces the male (antheridial) and female (archegonial) structures. Sperm released from the antheridia reach the egg in the archegonia when surface water is present. Fertilisation produces the sporophyte, which develops on the female plant and releases spores. The diagram also shows asexual reproduction through gemma cups, which produce clonal units that spread easily in irrigation.

Clonal reproduction is the main way liverworts spread in production systems. Mature thalli produce gemma cups that hold hundreds of disk-shaped gemmae. Irrigation droplets move these gemmae easily, and dispersal has been recorded up to 1.6 metres. Each gemma grows into a clone of the parent plant, so colonies expand fast once cups appear. Liverworts can also be spread through fragmentation. Small pieces of thalli that cling to tools, gloves or clothing can start new plants in other parts of the nursery. This means hand-weeding often fails unless all fragments are removed.

Liverworts also reproduce from spores which can survive for more than a year and germinate when conditions turn moist and cool. Together, gemmae, fragments and spores make liverworts difficult to remove once they are established.

Once liverworts appear, growers need to combine physical, cultural and chemical controls to prevent spread. Trials highlight several important cultural strategies to reduce establishment:

- substrate stratification, placing coarser media at the surface of the container.
- incorporating fertiliser within the soil media rather than topdressing.
- mulching with coarse materials to lower surface moisture.
- improving airflow, reducing shading and allowing the surface to dry between irrigations.

Hand-weeding is often necessary but has limitations. It is labour-intensive, removes potting mix and top-dressed fertiliser and can injure crop roots. Small fragments often remain and can re-grow. Chemical controls are available but need careful timing and may cause phytotoxicity. Dead liverworts left on the surface still affect pot appearance and saleability and must be removed manually.

Effective liverwort management relies on early detection, reducing the surface conditions that favour growth and combining cultural strategies with well-timed chemical controls.



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# Managing weed resistance

As you have just read, weeds are pernicious and need to be controlled frequently to avoid them setting another load of seed to enter the soil seed bank.

In most nurseries, weeds are controlled with herbicides. This is where, if one is not careful after using herbicides for many years, weeds may fail to die. We call this **herbicide resistance**. Herbicide resistance is not *caused* by repeated use of herbicides, rather, it is selected for with repeated use of herbicides. It is simply evolution in action. Mutation is the raw material for evolution. Mutations in the genetic code of plants (and insects, mammals, humans and all life) occur all the time, with the vast majority of these having little function, but a very small percentage of these mutations may affect the appearance or wellbeing of plants in an observable way. One of these is to make a single plant actually resistant to a herbicide. If that same herbicide is used on that plant, it will fail to control it, and the plant will survive and set seed. This is 'selection', the force that drives evolution. Depending on the pollination and genetics of the plant, and the way that mutation is inherited will then determine how many of the next generation seed carry the resistant gene. Those plants that do will survive the next application of herbicide, and the population of weeds that don't die will rapidly multiply until the resistant gene has become dominant in that population. The solution to this problem is obvious, use a different herbicide – but unfortunately it is not quite that straight forward.

Let's look at how we might categorise herbicides. Firstly, the categorisation you are probably all familiar with based on how herbicides are *used* to kill weeds i.e.; pre-emergence herbicides which are usually applied to bare ground and control emerging weeds for various lengths of time, post-emergence herbicides which are taken up mostly by the foliage and die but also with some residual soil activity, and post-emergence



*Lolium multiflorum*



*Lolium perenne*

herbicides with no residual activity (this group is restricted to glyphosate, glufosinate and paraquat). Secondly, another common way is by *what* they kill i.e.; those that kill only grasses, those that kill only broadleaf weeds and those that kill both. Both of these categories are important for the way one controls their weeds and one's choice of herbicide but neither are necessarily helpful in avoiding the build up of resistant weeds. To do this we need to categorise according to the way a herbicide kills a weed which is called its **Mode of Action (MoA)**. Each mode of action kills a target plant by acting on different parts of the plant at a cellular level, from preventing photosynthesis, through blocking the production of important chemicals, to stopping cell growth or even rapidly accelerating growth out of control.

We mostly know herbicides by the name on the container, its **trade name** but we need to know more than that we actually need to know the name of the chemical that actually kills the plant, the **active ingredient**, and further the **MoA** that chemical used to kill the plant. This is especially important as different active ingredients can have the same MoA. Now, the MoA is a long, complex chemical description which most of us don't understand so for convenience the Herbicide Resistance Action Committee (HRAC) has grouped herbicides with the same MoA and given



*Poa annua*

that group a number. With this knowledge, we can now be specific about using a different herbicide to kill the growing population of resistant plants and reset the evolutionary clock.

Table 1 lists common herbicides used in nurseries, orchards and vineyards. They are first listed by active ingredient and secondly by the Group Number of their MoA. The third column is the various trade names that these active ingredients are sold as. It is not as simple as changing to a new herbicide but changing to a new MOA.

As well as changing the MoA, we need to use the second way of categorising herbicides (by which species it has activity on) to ensure that it will kill the target weed. Now we have a method to avoid the build up of resistant weeds.

**Every second or third year we should control our weeds with a herbicide with a different mode of action but we need to be certain that this new herbicide will control the weeds we want it to.**

Table 1: Herbicide active ingredients, their Mode of Action (MoA) Group and Common Tradenames

Active ingredient	MoA Group	Chemical Trade Name
Asulam	18	Asulox, Asucane, Asulan, Dockstar
Clethodim (240)	1	Cleo, Cletho, Sequence, Vega
Clethodim (360)	1	Arrow, Centurion, Colt, CropSure Clethodim, Execute, Graside, Millennium
Clopyralid	4	Archer, CropSure Coptrel, Donaghys Cronus, Ken-Trel, Multiple, Ralid Xtra, Versatill PowerFlo, Vivendi, Void
Diuron	5	Karmex
Flumioxazin	14	Chateau
Fluroxypyr	4	Fluroken, Solstar, Starane Xtra, Tomahawk, Tandus XL, Tyrant
Fluazifop	1	Fusilade Forte
Glufosinate	9	11 different tradenames
Glyphosate	10	33 different tradenames
Haloxyfop	1	Crest, Gallant, Haloxyken, Steed, Valianr
Indaziflam	29	Alion
Linuron	5	Afalon, Liron, Linex, Linuron
Oxyfluorfen	14	Baron, Fenox, Ox
Oxadiazon	14	Exadia, Forsite, Oracle
Paraquat	22	Speedy
Pendimethalin	3	Strada
Simazine	5	Simaflo, Simatop
Terbuthylazine	5	Grogard, Terbagran
Terbuthylazine + Diuron	5	Fenican

In New Zealand we now have 22 different weeds which have developed resistance to one or more herbicides. These have appeared in all agricultural sectors and also amenity turf. Nine of these which are relevant to nurseries are illustrated on page 12. The three most worrisome are annual and perennial ryegrass and annual poa. Ryegrasses are a problem due to their resistance to several different MoA's in New Zealand, including glyphosate (Group 10) and glufosinate (Group 9), and could be difficult to manage in a range of situations, and annual poa as it is quick growing, seeds rapidly and is already difficult to control with herbicides. The other weeds illustrate the range of species which have evolved herbicide resistance. There are also species common in New Zealand nurseries that have evolved resistance in nurseries overseas, including bitter cresses, fleabane, groundsel and willow herb, that are considered likely to become resistant.

With this in mind vigilance is important, if you notice a weed which you sprayed and expected to die – but it didn't, do something about it. Let your industry leaders know so that it can be tested and warnings go out. The industry already does not have a lot of options for rotating modes of action (Table 1) and we don't want to lose any due to resistant weeds.

# Herbicide resistance in NZ

## Species found in and around nurseries



Fathen  
*Chenopodium album*  
1979 atrazine, 2005 dicamba



Willow weed  
*Persicaria maculosa*  
1980 atrazine



Rayless chamomile  
*Matricaria discoidea*  
2023 sulfonylureas



Chickweed  
*Stellaria media*  
1995 chlorsulfuron



Black nightshade  
*Solanum nigrum*  
1999 atrazine, 2009 paraquat



Annual poa  
*Poa annua*  
2020 haloxyfop, 2021 iodosulfuron



Onehunga  
*Soliva sessilis*  
1999 clopyralid



Sow thistle  
*Sonchus oleraceus*  
2021 sulfonylureas



Perennial ryegrass  
*Lolium perenne*  
2012 glyphosate, 2014 sulfonylureas,  
2015 amitrole, 2021 Group 1

## Weed management – Checklist for nurseries



### Monitoring & Planning

- Conduct **weekly scouting**, especially in high-turnover areas.
- Train staff to ID weed species and growth stages.
- Keep records of weed species, control methods, and timing to refine your strategy.



### Prevention & Hygiene

- Store pots and trays in a protected area to prevent contamination.
- Inspect purchased **plants** to ensure they are free from serious weeds.
- Store media, compost, and fertiliser **off the ground** and protected to avoid contamination.
- Bag and remove hand-pulled weeds **immediately** to prevent seed spread.
- Regularly **sweep weedmat** and surfaces between crops to remove weed seeds.
- Use **coarse mulch** to discourage surface weed growth.
- Place **fertiliser below the surface** (3–4 cm) rather than topdressing, to limit weed access to nutrients.



### Physical Control

- Schedule **hand weeding every 2 weeks** to target short-cycle weeds before seed set.
- Use the “Pull-em or Leave-em” method: remove mature weeds, leave juveniles for next round.
- Focus on **high-risk areas**: pot edges, bench surfaces, propagation zones.



### Chemical Tools

- Apply **pre-emergent herbicides** correctly: calibrated spreaders, even coverage, right timing.
- Use **approved products** for gravel paths, surrounds, and non-growing zones to reduce incoming seed load.
- Rotate herbicide types to prevent resistance and maintain effectiveness.

# Weed Traits and Strategies

Plants weedy in the nursery environment tend to be those with...

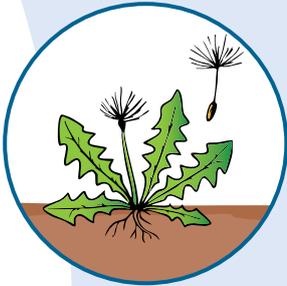


## **Rapid Growth and Maturation**

Weeds typically exhibit rapid growth rates, quickly establishing themselves in disturbed or bare soil before other plants can. Many can produce seeds quickly after germination, sometimes in just a few weeks.

## **Prolific Seed Production**

They often produce a vast number of seeds per plant, ensuring a large potential for future generations. A single gorse bush, for example, can produce thousands of seeds that remain viable in the soil for decades.

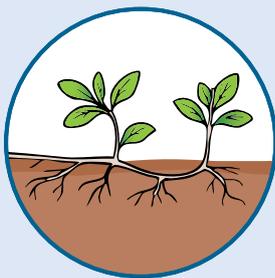


## **Effective Dispersal Mechanisms**

Weeds have evolved various ways to spread their seeds widely, including lightweight seeds carried by wind (dandelions, thistles), burrs that attach to animals or clothing, and seeds that float on water or pass unharmed through animal digestive tracts.

## **Seed Dormancy and Longevity**

Plants with seeds that can remain dormant in the soil for extended periods creates a persistent "seed bank" in the soil. They germinate when conditions are optimal, such as after a soil disturbance exposes them to light.



## **Vegetative Reproduction**

Many perennial weeds can reproduce asexually from roots, rhizomes (underground stems), or stolons (aboveground runners). Small fragments can regenerate into whole new plants.

## **High Adaptability (Phenotypic Plasticity)**

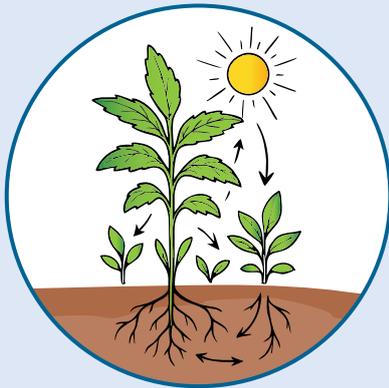
Weeds can tolerate a wide range of environmental conditions (e.g., poor soil, drought, temperature extremes) and can adjust their growth form (phenotype) in response to their surroundings.



## **Resistance to Control Measures**

Large populations and rapid life cycles, mean weeds can evolve resistance to herbicides over time.

## Competitive strategies and impacts in the environment:

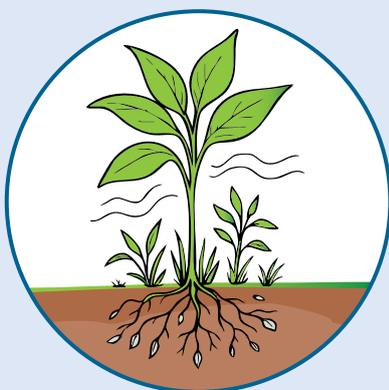
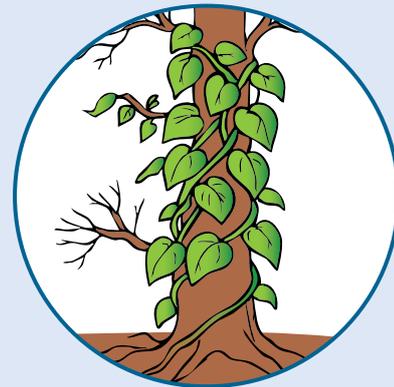


### ***Resource Competition***

Weeds aggressively compete with desired plants for essential resources such as sunlight, water, soil nutrients, and space. This often reduces crop yields or inhibits the growth and regeneration of native vegetation.

### ***Physical Smothering***

Particularly vines and scrambling plants (e.g., old man's beard, banana passionfruit), grow over and smother other plants and even mature trees, cutting off light and eventually causing the host plant to collapse and die.



### ***Altering the Environment (Allelopathy)***

Certain weeds produce toxic chemicals (allelochemicals) that inhibit the growth of nearby plants, giving themselves a competitive advantage. Others can alter soil properties, fire frequency, or water flow in ecosystems.

# Detecting new weeds before they spread

Weeds are one of the biggest threats to New Zealand's natural ecosystems. Around 400 species are already causing major damage, from choking wetlands to smothering forests.

Another 1,800 species are in the early stages of spreading in the wild, and some of the remaining 25,000 exotic plant species will inevitably escape into the wider landscape.

The cost of weed control is high, with more than \$50 million spent each year. Climate change is likely to make the problem worse by speeding up the spread of existing weeds and creating conditions that suit new ones. Despite this, New Zealand still lacks a reliable way to detect new weed incursions early. Currently, detection often depends on luck – someone noticing a plant simply because they happen to be in the right place at the right time. By the time a new species is recognised as a threat, it is often too widespread and expensive to remove. This weakness in the biosecurity system was highlighted in the 2021 Parliamentary Commissioner for the Environment's report on weed management.

### A Smarter Way to Spot Weeds

To address this, DOC weed ecologist Kate McAlpine, technical lead Nigel Charman, and Wellington-based developers Xequals are creating a Smart Weed Alert Tool (SWAT). This is a digital system designed to detect invasive weeds as soon as they appear.

SWAT works by scanning the Global Biodiversity Information Facility (GBIF), an international database of species observations. Users can customise their own filters, such as a specific region or a category of weeds like those listed on the 2024 environmental weeds list. When a new exotic plant record appears in New Zealand that matches the user's alert criteria, SWAT sends an alert. Importantly, users do not need to know in advance which species to watch for. If a new or unusual plant is recorded in their area, they will be notified automatically.



Kate McAlpine inspecting a Chilean myrtle tree (*Luma apiculata*) in Chile.

### Why It Matters

The benefits of SWAT are clear:

- It shifts weed detection from chance sightings to systematic surveillance.
- It allows alerts to be customised, so councils, DOC staff, community groups or individuals receive information that is directly relevant to their needs.
- It harnesses the growing power of citizen science. Observations uploaded to iNaturalist feed into GBIF, which means that people across the country are contributing to a national early-warning system.
- It grows stronger over time. As more data from councils, DOC, researchers, and citizen scientists is added to iNaturalist and GBIF, the accuracy and reach of the alerts improve.
- It saves money and biodiversity by enabling faster control. Weeds detected at an early stage can be removed before they spread widely, making eradication achievable.



The cost of weed control is high, with more than \$50 million spent each year.

A smothering tangle of hops (*Humulus lupulus*) in a nature reserve. Photo: Raul Johnson

### Citizen Scientists at the Core

One of the most important features of SWAT is its connection to citizen science. When a person uploads a plant observation to iNaturalist and its species ID is confirmed by experts, the record automatically feeds into GBIF. SWAT then picks it up and, if relevant, sends an alert. This loop means that everyday people are helping to protect biodiversity, and they can see the value of their contributions in real time.

### Looking to the Future

The team developing SWAT sees its potential reaching well beyond weeds. The same approach could be used to track other invasive organisms such as fish, invertebrates, or fungi. The system will be open source and free to use, giving anyone with an interest in biosecurity access to the tool.

By turning scattered sightings into a coordinated national system, SWAT offers New Zealand a smarter way to stay ahead of invasive weeds. Early detection means early action, which reduces costs and protects the unique ecosystems that make this country special.



Tree Lomatia (*Lomatia fraseri*) disperses by wind-borne winged seeds and is spreading in the Wellington region and locations near Christchurch.

# Protecting plant production from exotic weeds

The Ministry for Primary Industries (MPI) manages plant pest and disease risks through a multi-layered biosecurity system that operates offshore, at the border and post border. Suspected exotic plant pests or diseases are directed to the IncurSION Investigation Plant Health (IIPH) team through the Exotic Disease and Pest Emergency Hotline (0800 80 99 66) or via the online notification tool (ONIT) at <https://report.mpi.govt.nz/pest/>.

IncurSION investigators are on duty every day. When a notification is received, the investigator interviews the notifier and assesses the situation. This may involve a site visit, specimen collection and risk analysis, followed by any actions needed to prevent spread or support further investigation.

The team regularly receives reports about exotic weeds, often detected by nursery and seed industry staff in imported material or observed growing in the



Golden dodder

wider environment. Some of these weeds are classified as Unwanted Organisms under the Biosecurity Act 1993. Investigators work closely with botanists at the MPI Plant Health and Environment Laboratory (PHEL) to confirm species identity using field observations, herbarium material and laboratory diagnostics. Once an exotic weed is confirmed, further actions depend on the species and the extent of spread. These actions may include removing or treating infested plants, carrying out targeted surveillance and working with regional councils to prevent wider establishment. Information sharing with councils and other agencies is routine and helps align surveillance and response.

**Report an exotic pest  
or disease**

**0800 80 99 66**



**Biosecurity New Zealand**

Ministry for Primary Industries  
Manatū Ahu Matua

Two recent investigations highlight how MPI manages post border weed incursions in nursery settings. One of them has been published in the Surveillance magazine.

In 2022, an investigation found that a Canterbury nursery was selling plants labelled as *Erica* spp. that had been sourced from Southland. The plants were identified as two cultivars of *Erica cinerea*, an Unwanted Organism. The IIPH team confirmed the identification and issued a Notice of Direction requiring disposal of the remaining stock. The nursery removed the cultivars from sale and destroyed them. MPI also directed the nursery to resources such as the Plants Biosecurity Index, the Official New Zealand Pest Register and the relevant Regional Pest Management Plan to help prevent future issues.

Golden dodder (*Cuscuta campestris*), a highly parasitic Unwanted Organism, was detected in 2023 in a Mingimingi (*Coprosma crassifolia*) crop at a Canterbury nursery. After confirming the identification, the IIPH team instructed the nursery to isolate the affected crop. Infested plants were disposed of securely and customers who had purchased the material were contacted to check their stock. The nursery introduced staff training and strengthened quality control procedures. MPI also notified the Department of Conservation and Environment Canterbury to support wider monitoring.

These cases demonstrate the value of early reporting by nursery staff and the importance of prompt investigation to prevent exotic weeds from becoming established. Plant producers are encouraged to stay alert, make use of tools such as Plant Pass to support strong biosecurity practices and report any unusual weed species to MPI. This shared vigilance helps protect New Zealand's plant production systems.



Golden dodder

Plant producers are encouraged to stay alert, make use of tools such as Plant Pass to support strong biosecurity practices and report any unusual weed species to MPI.

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# Weed Biocontrol – Reuniting plants with their natural enemies

Many invasive plants in New Zealand were introduced without their natural enemies — insects, mites, fungi, or bacteria that limit their dominance in their native range. In their absence, plants can spread unchecked, becoming invasive in their new environments. In their native ecosystems, weeds are held in balance through long-term co-evolution with their natural enemies, which often leads to host specificity.



Since the early 2000s, four biocontrol agents — including the Tradescantia stem beetle (*Lema basicostata*) — have been introduced from Brazil to control *Tradescantia fluminensis*.



'No-choice' testing: Insects are placed in cages with individual plants with no other food source available.

Classical biological control seeks to restore this balance by introducing carefully selected natural enemies from the plant's native range into New Zealand. These agents are chosen for their high host specificity and effectiveness. Sometimes multiple agents are needed for effective control, targeting different parts of the plant such as leaves, stems, seeds, or roots, without competing with each other.

### Safety Testing of Biocontrol Agents

Before release, every potential agent undergoes rigorous host-specificity testing. In New Zealand, this work is carried out by scientists at the Bioeconomy Science Institute (BSI) who start by testing the agent against the closest relatives of the target weed and gradually expanding to more distantly related species, including indigenous species as well as economically, culturally and otherwise valued species. In "no-choice" tests, the agent is confined with a single non-target plant species. If it refuses to feed or reproduce, the plant is deemed safe. If any feeding or development is observed, further testing determines whether this behaviour would persist under natural conditions.

This approach, backed by decades of international experience, underpins the high safety record of weed biocontrol globally and in New Zealand.

### How Targets Are Chosen

The selection of weed targets for biocontrol is coordinated through the National Biocontrol Collective (NBC) – with biocontrol scientists from the BSI acting as science provider. A prioritisation tool guides this process by assessing weeds against agreed criteria, including ecological impact, feasibility of control by other means, urgency of the issue, and likelihood of success.

Additional considerations include the weed's reproductive strategy, availability of agents overseas, and potential opposition to the biocontrol programme. Key stakeholders are consulted as early as possible if there are potential concerns. For example, medical herbalists were consulted about the horehound (*Marrubium vulgare*) biocontrol programme, because they harvest plants in the wild for use in some of their products.

For weeds on productive land, farmer groups sometimes take the lead by contributing funds to have a weed targeted for biocontrol, typically in partnership with other co-funders. Commercially important plants, like kiwifruit or hops would never be targeted for biocontrol because of the obvious risk to New Zealand's economy.

Once approval is granted by the Environmental Protection Authority (EPA), BSI mass-rears the agent for release. After establishment is confirmed, agents are redistributed from successful sites to new locations with help from local councils.

### How Safe Is Biocontrol?

Weed biocontrol has an excellent safety record worldwide. Over 600 biocontrol agents have been released against more than 260 weed species, with only four recorded cases of serious non-target impacts which occurred before the development of modern testing protocols and best practice risk assessment.

In New Zealand, seven biocontrol agents have affected plants other than just their intended targets, causing minor non-target impacts. For instance, the gorse pod moth (*Cydia succedana*) was found to attack not just gorse (*Ulex europaeus*) but also Scotch broom (*Cytisus scoparius*) due to a broader host range in moths from one of the two source populations used for releases. This led to stricter rules around population testing.

The Californian thistle beetle was released in 2007 to control a range of thistle species, in the knowledge that it might also attack globe artichoke. Since then, attack on globe artichoke has occasionally been reported, but appears to be generally very minor and greatly outweighed by the benefits derived from the beetle's impacts on invasive thistles.



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# Environmental Pest Plants

## Success Stories in New Zealand

**Tradescantia** (*Tradescantia fluminensis*) was introduced from Brazil in 1912 as a garden plant, and has become a serious forest invader, forming dense mats that smother native seedlings. A collaborative research effort between NZ and Brazil began in the early 2000s to search for biocontrol agents. The first agent was released in 2011, followed by releases of three other agents in 2012, 2013 and the last one in 2018. These agents target different plant parts and are now reducing weed dominance in many infested sites, allowing native seedlings such as kahikatea (*Dacrycarpus dacrydioides*) to re-establish.

**Mistflower** (*Ageratina riparia*) was found by the mid-1980s to choke stream margins and forest understorey in northern New Zealand. Two agents were introduced: a white smut fungus (*Entyloma ageratinae*) in 1998 and a gall fly (*Procecidochares alani*) in 2001. Both have performed strongly. Specifically, two indigenous plant species that were on the list of threatened plants due to mistflower are no longer under threat.

**Alligator weed** (*Alternanthera philoxeroides*) was first detected as a problem in the early 2000s and is notoriously hard to control due to its spread through fragments and the restriction on herbicide use near water. Two agents, a beetle (*Agasicles hygrophila*) and a moth (*Arcola malloi*), were introduced in the 1980s to defoliate the plant. They have provided good control in lakes and ponds, although they are less effective in periodically flooded or frosted areas.

**Heather** (*Calluna vulgaris*) was planted in Tongariro National Park in 1912 to support grouse that were to be introduced as game birds. The heather thrived and soon dominated virtually all areas previously covered by the native and endemic red tussock. The heather beetle (*Lochmaea suturalis*) was released in 1996 and after a slow start, beetle populations exploded in some areas, leading to visible dieback of heather and gradual re-emergence of native vegetation.



Before: Tradescantia 2020, Onewhero/Waikato



After biocontrol release 2023



Before: Mistflower, January 2000, Brookby/Auckland



After biocontrol release November 2001



Before: Alligator weed, 1980s, Lake Whatipū/Auckland



After biocontrol release: visible damage



Before: Heather, 2008, Tongariro National Park



After biocontrol release 2018

**Ragwort** (*Jacobaea vulgaris*) was once widespread across New Zealand pastures. The weed is toxic to cattle and farmers spend large sums to control the weed by spraying. In the 1920s and 1930s the Cinnabar moth and a seed fly were released but the impact was patchy. The ragwort flea beetle (*Longitarsus jacobaeae*) was released in the 1980s, and quickly provided excellent control in low rainfall regions. It was later accompanied by two additional agents, to help control ragwort in areas where conditions were too wet for the beetle. Together, these agents have drastically reduced ragwort infestations.

### Looking Ahead

Biological weed control remains one of the most environmentally sound and cost-effective approaches for long-term weed management. Its success depends on rigorous science, inter-agency collaboration, and public support/buy-in.

With climate change accelerating weed spread and undermining traditional control methods,



Before: Ragwort, 2009, Makarora/Otago



After biocontrol release 2012

biocontrol offers an alternative to chemical use and hand weeding, to help restore native ecosystems, and support resilient land management systems.

More information on weed biocontrol projects can be found on the BSI website (<https://www.landcareresearch.co.nz/discover-our-research/managing-invasive-species/weed-biocontrol>) and Facebook page (<https://www.facebook.com/weed.biocontrol>).

For information on how to obtain and redistribute agents, please contact your local council biosecurity officer.

**Luise Schulte**

**Researcher – Plant Pathology, Bioeconomy Science Institute.**

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