Chickweed

Stellaria media

Weed management guide for Australian vegetable production

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Identification

Chickweed (*Stellaria media*) is a branched sprawling annual herb, native to Europe, with delicate stems up to 60 cm in length but usually 5-40 cm in length.

Leaves are between 1-3 cm in length, usually almost free of hairs, bright green, and oval to broadly elliptical in shape, with pointed tips. The numerous flowers are white, 3.0-6.5 mm in width when fully open, and comprised of five deeply divided petals (giving the appearance of ten petals), and are surrounded by longer hairy sepals.

Plants are diffusely branched from the plant base, with a distinct line of hairs visible between the stem joints (nodes). Roots are capable of forming from the lower nodes. The root system is shallow, dense and fibrous, and features a slender tap root.

Most vegetable farmers will be well aware of chickweed and how to identify it. However in some cases, depending on stage of growth and experience in identification, it may be possible to mis-identify chickweed as certain other *Stellaria* species, for example lesser chickweed (*Stellaria pallida*). Chickweed also closely resembles pimpernel (*Lysimachia arvensis*), a weed sometimes found on vegetable farms. However, pimpernel may be distinguished most readily by having either red or blue/purple flowers, and somewhat fleshier leaves.

Figure 1 includes a series of photos of chickweed at different life stages in order to facilitate correct identification on-farm, from a young seedling through to mature plants and flowering.

Figure 1 Life stages, from emergence to flowering

Characteristics

Key characteristics

Table 1 Key characteristics of chickweed

Time of germination	Year round (moderate climates); peaking in autumn and to a lesser extent spring
Time of flowering and seed set	Flowering 4-5 weeks after germination; seed set 5-7 weeks after germination
Reproduction	Primarily by seed; some short-term vegetative reproduction possible
Seed productivity	Up to 30,000 seeds/plant
Seed viability	Up to 60 years depending on conditions, though commonly about one year
Optimum germination soil depth	Between 0.5 and 1.0 cm below the soil surface
Soil type/s	Favours moist fertile soils with neutral pH
Competitive advantages	Year-round germination; early emergence; rapid growth, flowering and seed set; long-term seed viability; high seed production; capable of vegetative reproduction

Seasonality

Chickweed commonly grows as a winter annual, generally with a lifespan of 2-3 months. It prefers cooler humid conditions, and well-watered areas, and is thus well adapted to the conditions found in cooler-climate vegetable production systems in Australia. It is tolerant of temperatures as low as -4°C, with flowers capable of maturing under snow in winter climates.

Seedling emergence can occur throughout the year, but tends to peak in autumn (and to a lesser extent spring). In warmer climates chickweed can grow and produce seed year-round. Depending on time of year plants germinate, flowers can appear within 4-5 weeks of germination, and mature seed within 5-7 weeks. Summer-germinating plants generally grow in a more upright fashion than more prostrate autumn-germinating plants.

Seed production

Chickweed is capable of self-pollination, and this is the primary form of pollination of the species. Plants can produce seed for up to 3 months. Seed is usually 0.8 to 1.3 mm in diameter, reddish-brown, dark brown or yellowish, rounded with a flat top. Seed production tends to be anywhere between 2 and 17 seeds per capsule, while research suggests that up to 30,000 seeds per plant can be produced. Up to three generations of plant can be produced per year in ideal conditions.

Seed germination and viability

Seed viability varies across sites, but seed can reportedly remain viable for up to 60 years. However the proportion of viable seed tends to decline quickly over time, with over 90% of seed being viable after one year, and as little as 6% after ten years.

The optimal temperature range for germination is 12°C to 20°C, but can occur within a range of 5°C to 30°C - contributing to its capacity to emerge year-round. The ideal depth for germination of chickweed seed is 0.5 to 1.0 cm, although seed are also capable of germinating on the soil surface. Seeds rarely germinate at a depth of greater than 2 cm.

Soil preference

Chickweed grows in a variety of soil types, but is most successful on moist, fertile soils with neutral pH, high nitrogen and good aeration. It is less successful on acid soils.

Methods of spread

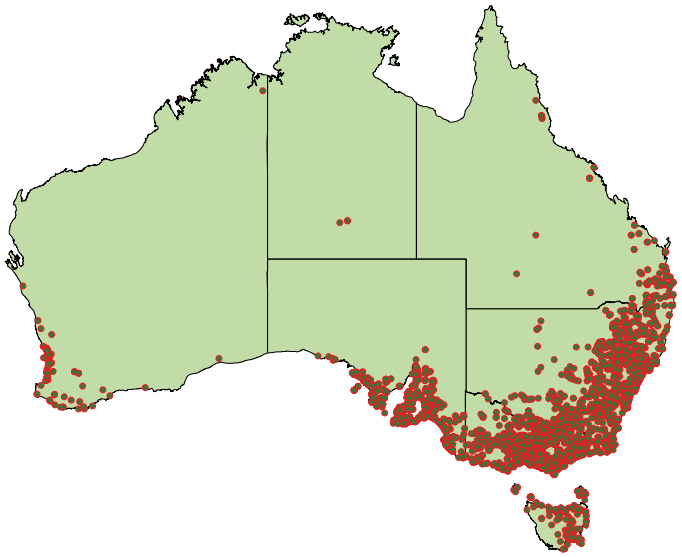
The majority of chickweed seeds are dispersed close to the parent plant. However, means of wider spread include:

- via natural pathways such as wind and water;
- via animals (domesticated and wild, including viable seed found in the gut of animals); and
- via human activities such as commercial seed purchases, attachment to clothing and shoes, and vehicles and machinery.

Once chickweed has spread to vegetable fields, populations can increase rapidly. It is also capable of reproduction from plant fragments.

Distribution

Although only a relatively small plant, chickweed is a common and significant weed of cultivated fields, including in winter and spring cereal crops as well as vegetable crops. In Australia, it is found in all mainland states where it is a common weed of vegetable crops in cooler or temperate climates. It is also a significant weed of vegetable farming in Tasmania.



Map 1 Australian distribution of chickweed (source: Atlas of Living Australia)

Figure 2 **Regular soil disturbance and addition of organic materials, and heavy seeding of the weed, means that chickweed can quickly become dominant within vegetable crops. Within higher stature crops, such as this 'Caliente' mustard (*Brassica juncea*) cover crop, its direct competitive impact on the crop will be less significant. However, its capacity for growth and seeding beneath a relatively open canopy has implications for following lower stature crops.**

Impacts

Despite being relatively small and frail, the frequently disturbed soils characteristic of vegetable farming favour chickweed, particularly in temperate vegetable production regions. Its competitiveness with crops is assisted by its ability to germinate throughout much of the year, the relatively short time it takes from germination to flowering and seed set, and its adaptability to a variety of climatic conditions. Around the world, chickweed is considered one of the most successful weeds of cultivation. It is adaptable to the varied cultivation regimes of winter and spring cereals as well as vegetable crops, and has been reported as a weed in over 50 countries worldwide.

Crop competition and contamination

Most of the research on chickweed has focused on its impacts on broadacre cereal and grain crops rather than vegetables, however within a range of these crops chickweed has been found to result in notable yield reductions due to competition for nutrients, light and water.

Early emergence and a rapid growth rate gives chickweed a competitive advantage over crop plants in temperate climates. Chickweed displays vigorous early growth, and will have the greatest negative impact on crop yield when it emerges at the same time as, or just before, crop plants. Early establishment also results in larger more competitive individual plants being found. In Australian vegetable production, competition and contamination has been noted as a problem for lower stature vegetable crops, for example machine-harvested cut-leaf vegetables such as spinach and baby leaf lettuce.

Nonetheless, chickweed has also been found to compete relatively poorly with established crop plants, particularly those that are higher in stature. In these conditions, later emerging chickweed plants tend to be smaller and less competitive. Effective chickweed control to minimise its competitiveness at the time of crop establishment is therefore vital to reduce its impact on the crop.

A host of pests and diseases

Around the world, chickweed has also been noted as a host for a variety of aphid species known to be vectors for viral diseases of cultivated crops. It is also a host plant for a number of nematode species that can infest cultivated crops.

Chickweed also hosts a number of vegetable crop viruses, including beet yellows and beet mild yellowing virus, cucumber mosaic virus, tomato spotted wilt virus, and tomato blackring virus.

Management

Management methods

Table 2 Chickweed management methods

Activity	Suitability	Notes
Tillage	✔ ✔	Complete early in lifecycle for best results. May include stale seedbed. Inversion ploughing not recommended due to long seed viability period.
Cover crops	✔ ✔	Feasibility of cover crops dependent on cash crop produced and viability of non-crop period in annual rotation. Thick canopy effective in reducing chickweed germination and seed set. Good establishment is critical.
Planting density	✔ ✔	Plant crop at highest practical density without impacting on crop yield, to increase competition.
Farm hygiene	✔ ✔	Best suited to farms with no current chickweed infestation, or an infestation restricted to one part of the farm.
Hand weeding	✔	As follow-up to early-stage herbicide and tillage. Hand weeding is expensive and not suitable for wide-scale use. Suited to lighter infestations of smaller plants, or occasional larger plants. All plant parts removed to avoid re-growth.
Herbicides	✔ ✔ ✔	No later than 3 weeks after emergence. Herbicide resistance currently restricted to non-vegetable industry herbicides.
Biological control	**N/A**	Not currently available.
Integrated weed management	✔ ✔ ✔	Precise combination of techniques will vary from farm to farm. Early control with herbicides or tillage is critical, while the plants are vulnerable and easy to remove, and before further weed seed production.

Tillage ✔✔

Tillage can effectively manage chickweed providing it is completed early in the plant life stage. It is recommended to monitor the soil surface for chickweed seedlings during autumn and winter, and control through shallow cultivation. Tillage is also considered to be more effective for chickweed control if carried out on dry soils. However, tillage is not considered to be particularly effective where chickweed plants are larger, as plant fragments are capable of re-rooting if left partially covered by soil.

Research conducted in the UK has showed that tillage activity reduces chickweed biomass to a greater extent through spring harrowing compared to autumn harrowing, suggesting that time of year influences the effectiveness of tillage for chickweed control, as well as plant life stage.

Another overseas study confirmed the effectiveness of tillage by finding chickweed occurring more frequently in no-till than tilled plots.

Soil disturbance by tillage before crop planting at a depth of 2.5 to 5 cm can be highly effective at managing chickweed, by stimulating germination and then controlling recently germinated weeds when they are still small, fragile and not capable of re-rooting from fragments. This control option is commonly known as the stale seed bed technique, and may be useful in encouraging chickweed emergence prior to crop sowing to deplete the weed seed bank.

The capacity of chickweed seed to remain dormant in the soil for many years suggests that inversion ploughing or deeper ripping may create problems, either by bringing long-dormant chickweed seeds to the surface, or burying large numbers of viable seed to become a future problem in the paddock.

Figure 3 A shallow 'tickle' till within the crop row and between the plants early in their life cycle (and early in the chickweed life cycle) may help to manage recently germinated chickweed plants, allowing the crop to form a canopy before the weed problem becomes significant within the rows. Relevance of this technique will depend on crop/s grown, and availability of inter-row tillage equipment. In this crop in South Australia, a Weed Fix cultivator is used to manage weeds such as chickweed within the crop beds.

Cover crops

Cover crops grown in the period between vegetable cash crops offer growers an opportunity to reduce the impact of chickweed on their farm. When cover crops are well established and maintained, they can be expected to reduce chickweed emergence, flowering and seed set through competition for resources (soil nutrients, water and light), and potentially as a result of their biofumigant effects.

At a cover crop trial site in Tasmania, chickweed was observed to have emerged, grown and set seed to a greater extent within the biofumigant crop 'Caliente' than within a comparison Italian ryegrass cover crop. While 'Caliente' is a tall and vigorous cover crop, the space available beneath the canopy may have provided sufficient light for chickweed to mature and set seed. However, research in the United States suggests that mulching biofumigant cover crops may have a beneficial impact in suppressing chickweed through their allelopathic effects.

In the Italian ryegrass cover crop in the Tasmanian trial, some chickweed plants were observed having grown above the crop canopy, flowered and set seed, however this was relatively rare. There were large numbers of small chickweed plants beneath the canopy, however these had rarely flowered and set seed.

Selection of cover crop variety will need to take several factors into account, such as cost of and ability to grow the cover crop, its expected soil health benefits, relevance for breaking the disease cycle within the cash crop, and overall contribution to cash crop productivity. As the Tasmanian example shows, good establishment and a thick canopy is critical for achieving effective chickweed management using the cover crop.

Figure 4 High biomass winter cover crops such as Italian ryegrass (Lolium multiflorum) growing here on a research farm near Devonport, Tasmania, appear to be effective at suppressing growth and seed set of chickweed due to their high biomass and dense canopy. Good management of the cover crop is required to maximise its performance and biomass production.

Planting density

Agronomic practices such as increased crop density that contribute towards the rapid development of a thick canopy cover will result in fewer and shorter chickweed plants, fewer flowers, reduced seed production, and less return of chickweed seed to the soil. This principle is similar to selecting a competitive cover crop variety, as discussed above.

Competitive crop variety selection may result in more rapid establishment of crop canopy, and is likely to have similar effectiveness in suppressing chickweed emergence, growth and seeding, particularly if the chickweed has been effectively controlled immediately prior to establishment of the crop.

Where it is appropriate to the crop, higher plant density and variety selection (including shading of wheel tracks where this is possible) may contribute to reduced chickweed impact in the longer term.

Higher planting density may have some adverse effects, such as increased competition among crop plants (lowering yield) and greater risk of soil and plant diseases.

Figure 5 On a small area of this farm near Gingin, Western Australia, chickweed had become a significant problem within the lettuce crop and was dominant in the wheel tracks. While less feasible within this particular crop, this example illustrates that establishing a thick crop canopy (including shading the wheel tracks where possible) can be combined with other techniques such as tillage, pre-plant/pre-emergent herbicide application and selective hand weeding, to suppress chickweed and other weeds effectively within the crop beds.

Farm hygiene

Implementing appropriate farm hygiene practices helps limit the spread of chickweed seeds across and between properties, and onto crop beds from other parts of a property where the weed is present. Common practices include permanent or set vehicle tracks, equipment wash-down, and restricting movement onto the property.

While chickweed may be well managed within the crop beds, chickweed may still be present in wheel tracks, headlands, nearby non-crop areas and post-harvest crop residues, with plants going to seed and replenishing the seed bank both around and within the fields. Effectively managing off-bed chickweed plants may therefore reduce the burden of this weed within crop beds in the longer term.

Farm hygiene may be less relevant for managing chickweed where it has already spread across the whole farm. Other difficulties associated with this approach include the time required to wash equipment down thoroughly, and the potential for uncontrolled spread in flood prone areas.

Figure 6 Establishing a fixed equipment wash-down bay can help restrict the spread of chickweed on the farm, particularly where it is not present at all or only present on part of the farm.

Hand weeding

Physical control options include digging or hoeing plants out, or potentially pulling larger plants out by hand. Hand weeding can be a key component of achieving commercially acceptable levels of chickweed control, particularly where higher planting densities or larger crop plant sizes make tillage within the crop impossible.

Hand weeding may also be necessary to remove chickweed plants growing close to crop plants, in crop plant holes in a plastic mulch system, or more generally within the crop bed where selective herbicide options are not available, and where other attempts to manage the weed have been less successful.

Hand weeding is considered most likely to be effective for chickweed control relatively early in the life cycle of the weed. Given the weak structure of the plant, attempts to remove larger plants by hand can potentially result in stems and roots being left behind to re-grow and set seed. Furthermore, removing larger chickweed plants by hand and leaving some plant fragments behind may potentially see these re-root, grow and set seed.

Farmers are generally hesitant to implement wide-scale hand weeding due to its high cost. However, selective and timely hand weeding can be a very effective follow-up to tillage and herbicide control in particular, especially when implemented earlier in the crop life cycle. Removing a few remaining chickweed plants by hand and taking any flowering or seeding plants away from the paddock may have significant benefits in reducing the weed seed bank in future crop seasons. It may also help prevent herbicide resistance from developing.

Figure 7 Removing recently germinated chickweed plants before they have a chance to establish is an effective follow-up to pre-plant tillage and herbicide control, and will have longer-term benefits in reducing the weed seed bank. Tools that require relatively little effort and allow coverage of a large area of ground in a relatively short time, such as the wheeled scarifier pictured here, can make this task easier depending on soil type and moisture level, and weed plant size. Using this and similar tools for larger chickweed plants is unlikely to be effective.

Herbicides

In addition to knock-down options such as glyphosate or diquat, chickweed is susceptible to a range of herbicides in groups C, D, E, F, G, I and K. However, control effectiveness can vary depending on the stage of plant development.

A range of selective and non-selective herbicides are registered to control chickweed, across a variety of vegetable crops. Farmers should consult with their advisor or agronomist for specific product availability in their district, whether herbicide options are registered for the crop/s they grow, and the suitability of these products for their production system.

Table 3 Herbicides registered for management of chickweed in Australian vegetable production

Herbicide active ingredient*	Trading name/s	Group	Vegetable crop/s in which use is registered	Timing/crop growth stage
Chloridazon	Pyramin	C	Red beet, silver beet, baby leaf spinach	Post-sowing pre-emergence
Chlorthal-Dimethyl	Dacthal 900 WG	D	Brassicas, beans, peas, garlic, onions, carrots, lettuce, potatoes, turnips	At time of seedling or transplanting
Cyanazine	Bladex	C	Corn, onions, peas, potatoes	Post-plant pre-emergence or early post-emergence depending on crop
Dicamba	Cadence	I	Potatoes	Apply after haulm senescence
Diflufenican	Diflufenican	F	Peas	Post-emergence
EPTC	Eptam	E	Beans, potatoes	Pre-emergence
Ethofumesate	Tramat	K	Beets, onions	Pre- or post-emergence depending on crop
Ioxynil	Totril	C	Onions	Post-emergence
Methabenzthiazuron	Tribunil	C	Onions	Post-emergence (one or more true leaves in onion crop)
Metolachlor	Metolachlor 720EC; Meto-lachlor 960	K	Broccoli, Brussels sprouts, cabbage, cauliflower	Immediately after transplanting
Metham	Metham Sodium; Tamafume (fumigants)	N/A	All crops	Pre-plant
Metribuzin	Various	C	Peas, potatoes, tomatoes	Pre-emergence (potatoes), inter-row (tomatoes)
Oxyfluorfen	Baron 400 WG; Goal; Striker	G	Brassicas	Pre-transplant (7 days prior)
Pendimethalin	Rifle 440; Romper; Stomp 330EC; Stomp 440; Stomp Xtra	D	Carrots, peas, beans, onions, transplanted broccoli, cabbage, cauliflower, processing tomatoes	Pre-emergence
Phenmedipham	Betanal Flow 160 SE	C	Beetroot, silver beet	Post-emergence selective
Prometryn	Gesagard; Prometryn 900DF	C	Carrots, celery, potatoes	Pre-emergence, or early post-emergence in carrots
Propachlor	Ramrod	K	Onions, transplanted brassicas, beetroot	Pre-emergence, pre-transplant or at-transplant, depending on crop
Propyzamide	Various	D	Lettuce	Pre-emergence or immediately after transplanting
S-Metolachlor	Dual Gold	K	Brassicas	Immediately after transplanting
Simazine	Gesatop; Simagranz	C	Asparagus	Pre-emergence
Terbutryn	Terbutryn	C	Peas	Early post-emergence

** Details correct at time of writing; please consult the relevant herbicide label/s, contact your reseller for current registration details, or contact the Australian Pesticides and Veterinary Medicines Authority. This table does not include minor use permits, or non-selective options such as glyphosate or diquat. If using crop rotations, the APVMA Public Chemical Registration Information System database may be searched for 'chickweed' to identify a range of herbicides suited to a range of cropping situations.*

Herbicide resistance

Vegetable growers should remain aware of the potential for herbicide resistance to develop in chickweed and other key weeds, particularly if their crop rotation involves heavy reliance on a limited range of registered herbicides. Integrated weed management is of particular importance in reducing the risk of herbicide resistance developing.

There is growing evidence of chickweed resistance to ALS-inhibitor herbicides in North America and Europe, particularly in wheat production. This includes chlorsulfuron, metsulfuron, tribenuron, triasluflron, sulfometuron, flumetsulam, and imazapyr, though at the time of writing none of these were used in Australian vegetable production. Some resistant chickweed populations have also been found overseas to the herbicides MCPA and 2-4-D amine.

Figure 8 Pre-plant or pre-emergent herbicides are often one of the key techniques for management of chickweed in broadleaf vegetable crops, such as this lettuce crop near Gatton, Qld.

Biological control

Chickweed is somewhat susceptible to a variety of aphids, nematodes, fungal pathogens and viruses. However the significance of these biological agents lays in the fact that they also generally pose a significant risk to crop plants through cross-contamination (discussed above in 'Impacts'). At the time of writing there appeared to be no evidence of research to identify and establish a biological control agent for chickweed.

In general terms, biological control agents will only suppress growth and/or flowering of weeds, and will not achieve sufficient control alone.

Biological control is no silver bullet for success and therefore need to be integrated with other methods to achieve effective weed control. In Australia biological control has largely only been introduced for some perennial non-grass weeds in aquatic, pasture, and rangeland habitats. The short-term cropping season common in vegetable production makes it difficult for biological control agents to become established at effective levels. Therefore, vegetable farmers are unlikely to have the benefit of their use in the near future.

Bringing the control methods together

The three dimensions to success, most likely to provide effective control of major weeds such as chickweed, include 'Deliberation', 'Diversity', and 'Dedication'.

In applying this '3D' approach, a variety of options is available as described on the next page. This is commonly known as 'integrated weed management', and is likely to bring you the greatest chance of longer-term success in restricting the impact of chickweed on your farm.

Figure 9 Dedicated application of a well planned integrated weed management strategy can result in little weed impact by the time of harvest, such as in this Brussels sprout crop in South Australia.

Integrated management of chickweed

Integrating all available and feasible weed control techniques in a timely and diligent way has been shown to be very effective in bringing heavy infestations of broadleaf weed species such as chickweed under control on Australian vegetable farms.

This section has been adapted from the chapter 'Vegetable Weed Management Systems', written by Craig Henderson, and published in the book *Australian Weed Management Systems* (edited by Brian Sindel, University of New England).

Some practices may be implemented for reasons other than weed management, but still have weed management benefits.

Depending on the farmer's circumstances and resources and the extent of the chickweed infestation, whole-of-farm integrated weed management strategies may include the following:

- Shifting most cash crop production to the parts of the farm where the chickweed infestation is lower, or growing crops that are less likely to be impacted by the relatively prostrate growth habit of chickweed.
- *Repeated shallow cultivations* and *knock-down herbicides* may be used together to reduce the population of chickweed and other weeds before each crop planting. These approaches may include implementing a stale seed bed, and controlling recently emerged plants either by light tillage or herbicide application. Encouraging seeds to germinate and then controlling the plants before seed set can reduce the weed seed bank in the longer term.
- Including a cash crop or cover crop during the traditional non-cash crop period in the rotation allows use of *selective herbicide options* that have been registered for chickweed control. Fewer weeds may be expected to appear in the paddock when an out of season cover crop is grown. Including a fallow period in the crop rotation may also allow *non-selective herbicide* application to reduce the chickweed seed bank.
- Where a weed infestation is particularly heavy, it may be necessary to produce cash crops only during the warmest months of the year, when crop seeding or transplanting through to harvest is likely to take less time than during the cool season. This short crop production period may be beneficial in minimising the renewal of the chickweed soil seedbank, which is likely to be more dominant through the cooler months of the year. Once the crop is harvested, the residue can be quickly ploughed in to prepare the land for the next cropping sequence, also helping to prevent seed set by escapee weed plants.
- Implementing and rigorously adhering to a *farm hygiene* program, for example: undertaking thorough vehicle washdown in between farm sites (especially infested and non-infested areas); laying concrete or gravel tracks along major farm laneways to reduce the amount of soil being spread by vehicles; and planting a competitive grass species (e.g. Kikuyu) along laneways and drainage lines, and mowing these areas to minimise the chance of undesirable weed establishment. Farm hygiene reduces the potential for chickweed seeds outside the vegetable beds to act as sources for recolonisation, and is particularly relevant when parts of the farm are infested while others remain free of the weed.
- Use of a *drip irrigation system* can mean that the non-irrigated inter-rows remain dry (unless rain falls) throughout most of the growing period, with consequent reductions in chickweed and other weed populations. Such an irrigation system may be integrated with a *plastic mulch* in some high-value vegetable crops such as cucurbits. This will result in little chickweed emergence within the mulched crop beds, though farmers need to remain aware of the potential for weed seeds to germinate in the crop holes, as well as where the mulch has been punctured during laying or during crop management activities.
- *Close plant spacings*, *rapid crop growth* and *canopy closure*, combined with in-crop spraying of *selective herbicides* (where such options are available) can result in reduced emergence and seed set of chickweed in the vegetable crop. A similar approach may be pursued in cover crop rotations, and has been shown to suppress chickweed effectively due to competition.
- *Hand weeding* also has a role to play in an integrated approach, although is likely to be most successful early in the life of chickweed plants. Farm staff should be encouraged where possible to physically remove and destroy older weeds (particularly those flowering) that they come across in the course of their work, especially at harvest time when large numbers of workers are likely to be systematically moving through each field. However they must be sure to remove all plant parts to avoid fragments or remaining roots to re-grow and set seed.

Because annual broadleaf weeds such as chickweed rely in part on rapid turnover of large numbers in the weed seed bank to maintain high populations, an integrated management system of this nature can be expected to result in a relatively sharp decline in weed numbers over time. Nonetheless, farmers need to remain aware of the potential for chickweed seed to remain dormant for up to several decades depending on conditions, and therefore for germination flushes to occur at any stage given suitable circumstances.

However, integrated management of chickweed is likely to be effective in reducing its impact at relatively little extra cost to the farmer, given that most of the operations described above would still have been implemented for other reasons and have other farm and crop benefits.

The key to integrated management of chickweed is a planned strategy to link the key management components in a sensible sequence, and the persistence to ensure that each step is diligently carried out. In the longer term, integrated weed management may contribute to improved enterprise flexibility, where cash crops may eventually be grown at any stage of the viable production period without concern that this will result in a vast increase in weed numbers, or that the weed burden will impact too significantly on the cash crop.

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Disclaimer

Descriptions of herbicide use in this guide are not to be taken as recommendations. Herbicides must only be used in accordance with the recommendations provided on herbicide labels. Readers are reminded that off-label use of herbicides may be restricted or not permitted under relevant legislation. Landholders are therefore advised to determine current registrations and legal requirements for herbicides they may be considering, and to consult with their State or Territory government departments regarding the legal requirements they are obligated to adhere to relating to herbicide use and weed control.

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