

Integrated Weed Management for the Vegetable Industry



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Weeds have a significant impact

- Cost of management – herbicides, labour ...
\$2,090 per-hectare
- Reduce yield – compete with crop for resources
- Interfere with sowing and harvesting – large (e.g. mallow), prickly (e.g. stinging nettle), wrap around implements (e.g. wireweed)
- Affect quality – contamination and marking
- Act as hosts for pests & diseases
- Resistance, loss of management effectiveness??



INTEGRATED WEED
MANAGEMENT

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[Farm-level Economics Report](#)

Important weeds

- Growers and agronomists across Australia nominated the most important weeds in vegetable growing
- Many of the key weeds are common in all states
- Heavy seeding annuals e.g. fat hen
- Biennials/perennials with persistent roots, corms, tubers e.g. nutgrass
- Species that are difficult to control with herbicides e.g. pigweed
- Weeds related to the crop



Seeds quickly
Crop competition
Reduces yield
Hosts aphids



Spreads easily through tubers
Pierces plastic mulch
Difficult to control with herbicides



Difficult to control with herbicides
Interferes with cultivation
Crop contamination

Integrated weed management in practice

Key strategies

- Plan, do and review
Identify your weeds
Managing the weed seedbank is the goal
- Diverse, avoid patterns
Use multiple strategies
- Be strict about hygiene
Those seeds again!
- Diligence and timing
A stitch in time saves 9 ... thousand!



Planting a leek crop into stale seed beds

Integrated weed management

Tools

Use multiple strategies (diversity), and **plan** ahead

- Hygiene
- Cultural
 - Crop rotation to reduce seed bank, break cycles
- Mechanical
 - Early inter-row weed control (herbicide or cultivation)
 - Hand weeding (chipping)
- Biological
 - Biofumigant cover crops
- Chemical
 - Herbicides (pre-plant, selective)
- Other
 - Plastic mulch
 - Thermal control



Farm hygiene



- Preventing weed seeds arriving (farm-gate biosecurity)
- Cleaning weeds seeds off farm machinery
- Use dedicated, quarantined wash-down areas
- To limit weed spread between farms and between paddocks
- Start on the cleanest paddock

Herbicides

- Herbicide options include non-selective fallow, pre-emergent selective, post-emergent selective, and shielded inter-row non-selective.



- Where there are gaps in herbicide availability (e.g. managing broadleaf weeds in broadleaf crops) farmers rely more heavily on other methods.



Tillage

- Tillage equipment includes an inter-row cultivator (scuffler) to cultivate on top of the raised beds before the crop is planted or between the raised beds, and a 'Weedfix' cultivator to work within the crop after it is planted.



- Cultivation is carried out to form the raised beds in which vegetable crops are grown, and controls most weeds before planting. Later cultivation between the crop plants is carried out by some farmers.

Crop rotation

- Vary the crops grown, reduce seed bank, break cycles
- Different families have different needs and timings
- Enable different weeding methods to be used
- Benefits for pest & disease management
- Benefits for soil



Cover crops

- Physical competition: quick growing, dense cover such as ryegrass & other cereals, some legumes
- Biofumigation: relies on chemicals from the cover crop to suppress weeds (and soil pests), tricky to manage, only targets certain weeds, e.g. brassicas
- Issues: poor establishment, termination, weediness, lost income



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Mulch and hand weeding



- Plastic mulch is viable in some high value crops such as cucurbits (e.g. pumpkins, melons, zucchini), and capsicum. Controls many weeds, retains soil moisture, reduces crop spoilage.

- Hand weeding (hoeing, chipping, pulling) is carried out to control persistent weeds that are not controlled by the other methods, especially for in-row. Effective but expensive!



Other methods

- Biodegradable mulch, 100% biodegradable mulches break down on the ground reducing environmental impact; current efficacy trials in Australia
- Thermal weeding using steam, flame or hot water. Prevents soil disturbance, but expensive and selective
- Stale/false seedbeds – only feasible in districts where a fallow period is economically viable
- Solarisation - using clear plastic mulch to cover soil and ‘cook’ the weeds and seeds (and soil pests)

New technology



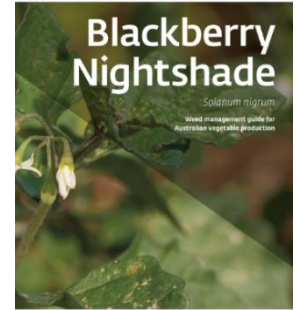
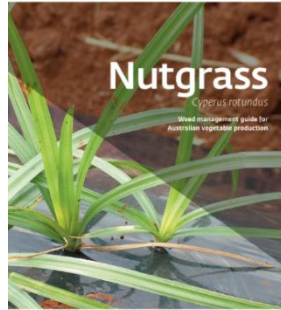
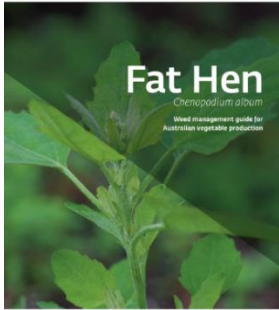
Emerging microwave technology for above ground weeds and below ground seed bank



Digital farm hand – multiple tools and applications

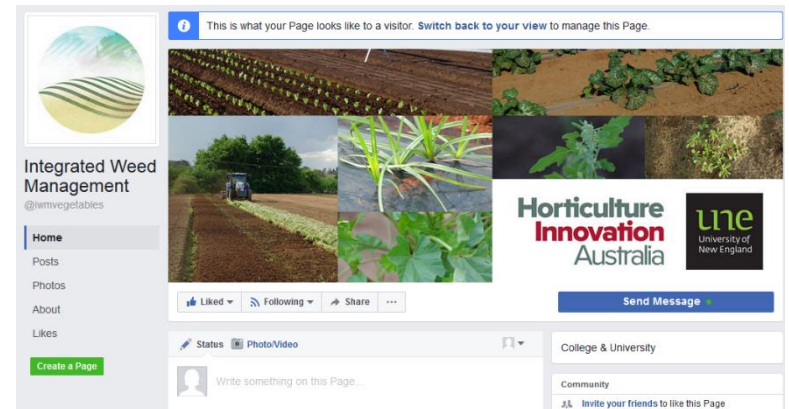
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Priority weed species 'Management Guides'



Download at: www.une.edu.au/iwmvegetables

Or find links to these @iwmvegetables





[Case study](#)

[Video](#)



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Former weed management approach

- Chemical fumigation of soil
- Frequent tillage, 3-5 passes
- Heavy reliance on pre-emergent herbicide
- Non-selective herbicide (glyphosate) across farm

Why did they decide to change?

- Ongoing weed problems
- Effects on staff time and morale
- Insect hosting
- Processing costs
- Pre-emergent herbicide reliance
- Dislike of weeds

New weed management approach

Hand weeding ✓✓✓

- Vigilant and comprehensive hand weeding at all stages

Herbicide ✓✓

- During short fallow periods
- Fence lines, buffer zones and nearby infrastructure

Tillage ✓✓

- Fallow and bed formation tillage



Field staff carry buckets during field activities to allow all weeds removed to be taken off-paddock to the farm's burn pile'.



Wide buffer zones around the paddocks are kept free of weeds using herbicide, to minimise the risk of weed seed spreading into the cropped area.

Benefits of the new approach

- Minimal weed impact after several seasons
- No need for chemical fumigation or residual pre-emergent herbicide use
- Reduced longer-term weed management costs
- Minimal contamination of harvested produce by weeds
- Improved staff morale and pride

The key principle of The Loose Leaf Lettuce Company's strategy is to *minimise the number of weeds that mature and produce seed.*

No matter what IWM approach is used, this principle is applicable to all vegetable farms.

Effective Integrated Weed Management - Case Study

*Managing weed seed banks through
stale seed beds and inter-row
cultivation*

Schreurs & Sons, Clyde, Victoria



[Case study](#)

[Video](#)



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Former weed management approach

- Regular and relatively deep cultivation passes
- Pre-plant and post-plant selective herbicides
- Hand weeding of survivors
- Chemical fumigation

Why did they decide to change?

- Reduced herbicide effectiveness
- More strategic reliance on herbicides
- A return to previous approaches
- A desire to reduce costs
- A desire to improve soil health
- Concerns regarding chemical fumigation
- A growing interest in organic production

New weed management approach

Cultivation to form beds ✓✓

- Single pass with chisel plough
- Two passes with bed former

Stale seed bed ✓✓

- Once each season for ~6 weeks
- Control of germinated weeds with glyphosate (preferred) or shallow tillage

Inter-row cultivation ✓✓

- Weedfix – rotating tynes
- Customised cultivator with Dutch hoe and knives
- Shallow and adjustable tillage between crop rows on the bed and in wheel tracks

Herbicide ✓✓

- Pre- and/or post-emergent selective
- Post-harvest non-selective herbicide

A stale seed bed, ready for crop planting.



Benefits of the new approach

- Gradually reducing the weed seed bank over time, especially of potentially herbicide-resistant weeds.
- Reducing reliance on herbicides, and improving capacity to use herbicides more strategically.
- Minimising weed germination and competition within the crop.
- Reducing weed management costs (especially cultivation and hand weeding) over time.
- Improving soil health through reduced usage of deep cultivation.

The key principle of the Schreurs & Sons strategy is to *minimise the number of weeds that mature and produce seed – particularly those weed species which they believe have started to show signs of resistance to herbicide.*

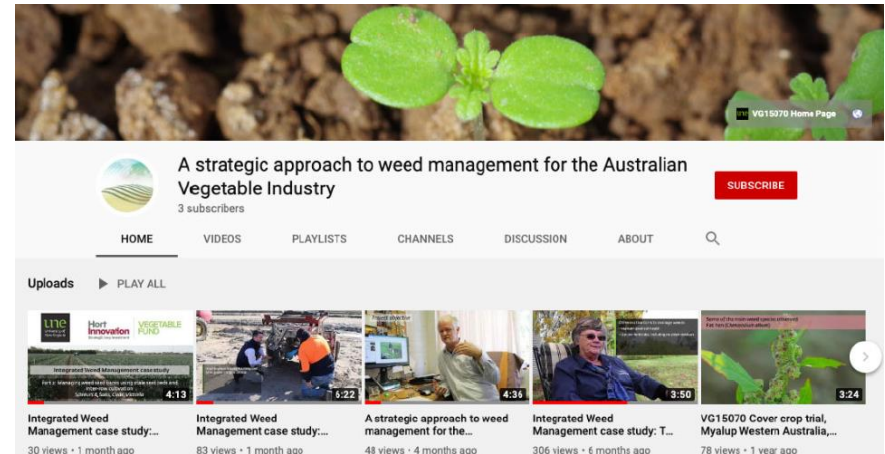
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Updates and Resources

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Thanks

To you for joining us! Hort Innovation for research funding, all farmers, industry extension staff and researchers who continue to support the project, and VG16078 SoilWealth ICP project for collaboration and extension opportunities.

