NSW GOVERNMENT Primary Industries

FACTSHEET

Lettuce Integrated Pest Management

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What is IPM?

Many insect pest and disease management problems arise from relying entirely on pesticides for control. Integrated pest management (IPM) is a strategy that draws on a range of management tools with the goal of using the least ecologically disruptive techniques to manage pests within economically acceptable levels. Pests can include insects, mites, diseases, nematodes, weeds and vertebrate pests.

IPM covers a continuum of practices which ranges from 'intelligent pesticide management' to biointensive IPM strategies. At the most basic IPM involves routine crop monitoring, to ensure that pesticides are only applied when needed, as well as to ensure appropriate timing of pesticide applications. The most developed *biointensive* IPM relies primarily on beneficial organisms to manage insect pests. When greater pest control is needed, interventions chosen are complementary to the survival of these beneficials. As other pests are incorporated more and more prevention strategies are adopted which reduces the need for direct control practices.

IPM is a model of continual improvement (see Figure 1). In lettuce growers adopting IPM typically focus initially on management strategies for a single key insect pest, such as Heliothis, Currant lettuce aphid or Western flower thrips usually after 'conventional' insecticides fail to control the pest adequately or are deregistered. As strategies are developed for the target pest, focus moves to other key or minor pests. IPM can become part of a fully integrated farm management system, and can potentially involve the whole market chain.

IPM considers the production system in a holistic manner, and looks at all aspects of the farming enterprise as potentially increasing or decreasing pest numbers and, where possible, enhancing the activities that reduce these pest populations.

Although this Factsheet uses insect pests as the main model, the same principles apply for diseases, weeds and vertebrate pests.

In natural systems, insect pest numbers are limited by food supply, climatic conditions and natural enemies, such as predatory and parasitic insects or insect diseases. IPM seeks to enhance, rather than disrupt, this ecological balance. Where direct control is needed, a management strategy is chosen that will reduce the pest population to within economically acceptable limits with minimal adverse impact on the environment.

IPM is knowledge-intensive. An IPM program is built on all compatible control tactics: cultural, biological, chemical, and mechanical; and aims over time to strengthen the preventative practices to reduce the need for control tactics.

IPM cycle

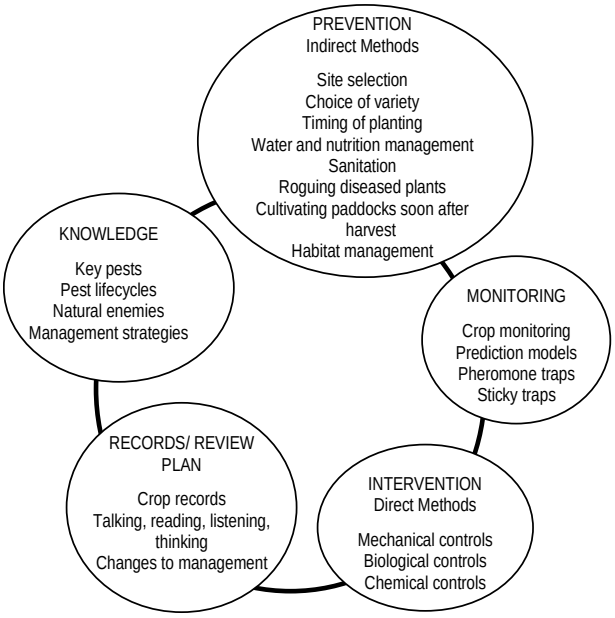


Figure 1. IPM cycle

Table 1. Common insect pests of lettuce (will vary between crops and regions)

Insect Pests	
Major	**Minor/sporadic**
Heliothis	Rutherglen bugs
Western flower thrips (WFT) (when virus present)	Cutworm, loopers, cluster caterpillars
Tomato or onion thrips (when virus levels high)	Thrips (when virus absent)
Currant lettuce aphid and other Aphids (when virus levels high)	Other Aphids (when virus levels low)
Silverleaf whitefly (QLD)	Wireworm & false wireworm (field only)

Table 2. Common diseases of lettuce (will vary between crops and regions)

Diseases	
Major	**Minor/sporadic**
Sclerotinia (lettuce drop)	Anthracnose
Tomato spotted wilt virus	Botrytis (grey mould)
Downy mildew	Septoria spot
Big vein virus	Rhizoctonia (bottom rot)
Pythium/Fusarium root rots (hydroponics)	Lettuce necrotic yellows virus
Bacterial soft rot	Lettuce, cucumber and turnip mosaic viruses
Tipburn (summer production)	Varnish spot
	Black root rot
	Bacterial leaf spot

Knowledge

It is important to develop an understanding of both key and minor (or occasional) pests that are found in crops in your area. Examples of common insect pests and diseases found in vegetable crops are listed in Table 1 and 2 (also see Lettuce Resources at the end of the factsheet).

It is equally important to know and understand the management options that are available to you as a grower. As more 'tools' become available, it is important to know when and how they can be used, and what effect they will have on the management of your pests. The knowledge that is developed about both the pest and the management tools available is also largely dependent on the local area and the experience you gain on your own farm. What works on one part of your farm may, for some reason, not work on another, and what works for your neighbour may not be the most appropriate option for you. The ideas behind IPM are based around knowing your 'enemy' and understanding the 'weapons' at your disposal.

Prevention

Where possible, it is preferable to prevent pest problems rather than manage them after they arrive – *prevention is always better than cure*. What measures you use will depend on your particular situation and what are your most serious pests. The following are some prevention strategies that can be important for lettuce:

1. Use varieties with as broad Downy mildew resistance coverage as is available and *Nas* resistance. In areas where lettuce big vein is a regular problem select more tolerant varieties.
2. Lettuce mosaic virus can be transmitted through seed so ensure seed is certified.
3. Seedlings are a common source of insect pests, diseases and sometimes weeds so either grow your own seedlings in a well insect-proofed greenhouse following stringent sanitation practices, or source from a reputable nursery. It pays to be aware of what the nursery's seedling management practices are. Note that if you are using biological control agents you need to know what insecticides the seedlings have been treated with as the residues may kill off beneficials in your system.
4. If possible, minimise susceptible crops in the ground during periods of high pest pressure.
5. In areas where thrips, particularly western flower thrips (WFT) and tomato spotted wilt virus (TSWV) are a problem, the removal of the surrounding flowering weeds is critical in managing these pests.
6. Sow thistles are hosts of lettuce necrotic yellows virus and should always be controlled.
7. Cereals planted near lettuce crops can be a nursery for aphid predators without hosting lettuce diseases.
8. In areas with regular problems with sclerotinia or other soil-borne fungal diseases apply a preventative fungicide spray after transplanting or thinning of a direct seeded crop.
9. Irrigating to minimise the period of leaf wetness will reduce foliar diseases.
10. When foliar diseases are present avoid working in the crops while foliage is wet to reduce spread.

11. Optimal nutrition – avoiding excess nitrogen will reduce crop susceptibility to some fungal diseases.
12. Chipping out and removing (roguing) diseased plants will reduce the source of host plants that assist in spreading infection to healthy plants. Once chipped the plants need to be properly destroyed: buried, bagged or removed from site.
13. Cultivating paddocks immediately after harvest, or if crop is abandoned for some reason, will reduce the harbouring potential for pests, and thus reduce their potential to spread to other plantings on your farm.
14. Soil amendments to improve soil structure, water infiltration and increase soil organic matter reduce a range of soil-borne diseases and can support soil predatory mites.
15. Use crop records to identify factors or management practices that may be encouraging or discouraging pests. Because IPM is knowledge-based and relies on local experience, this information will improve your ability to use IPM effectively in subsequent seasons, by allowing you to see what did and didn't work.

Crop monitoring

Routine crop monitoring is the first and most fundamental step in adopting IPM. It is important to keep check on the number of insects (both pest and beneficial) in your crop and to assess crop health. IPM growers starting out with IPM find it very helpful to contract a professional crop consultant to monitor crops on a regular basis. If you are monitoring yourself, ensure that you can identify the key insect pests, diseases and beneficials that may be present, and send specimens away for identification when there is doubt. All state departments of agriculture offer this service.

Follow a systematic protocol for monitoring, so that direct comparisons can be made of numbers found between monitoring dates and plantings, and keep accurate crop monitoring records so that you can develop a deep understanding of your crop system.

In lettuce visually monitor 40-60 seedlings and 20 hearted lettuce for insect pests and beneficials. Spread monitoring over at least 5-10 locations within a planting and include crop boundaries. Using a bug-vac on 100 seedlings can be substituted for visual monitoring.

Monitor for early disease symptoms by moving through the crop and collect samples for identification if symptoms are not recognized. In a crop showing disease symptoms evenly across planting note number out of 50 from two locations and add together to get percentage effected. Otherwise estimate density in effected area and note where in planting the problem extends.

Monitoring should be carried out on at least a weekly basis. During periods of high pest pressure monitoring twice per week may be necessary.

Pheromone traps can be used to monitor Heliothis moths. Pheromones are available for both *Helicoverpa armigera* (resistant to many older insecticides) and *H. punctigera* and can indicate flights of the target species; however, be aware that the traps attract male moths, and do not always give a good indication of the populations of female moths that are depositing eggs into the crop.

Figure 2. Pheromone trap for Heliothis monitoring

Sticky traps are also a useful tool for assessing thrips, whitefly and other small flying species. They are usually yellow, although blue traps can be used for monitoring thrips. In areas where tomato spotted wilt virus is common, sticky traps are regularly used to monitor levels of WFT.

Figure 3. Sticky traps for monitoring flying insects particularly thrips and whitefly. Blue traps are slightly more attractive to thrips than yellow.

Quality assessments at harvest are a better measure for comparing plantings and years than records of actual marketed product, as market standards vary during the season and between years depending on market supply.

Intervention

Crop monitoring information, past crop records, management options available, market requirements and expected damage all contribute to the decision whether to act or not.

For example if your monitoring shows Heliothis egg lay on seedlings but also a range of generalist predators you may choose to wait until you monitor again to see how many hatch. However if the egg lay is when lettuce is hearting and no predators were observed then a spray of Bt (a bacterial pathogen against caterpillars) or NPV (a viral pathogen insecticide for Heliothis) timed for hatching may be more appropriate. Similarly if early fungal foliar disease symptoms are showing and weather conditions are expected to be quite hot and dry and crops are otherwise healthy then you may choose not to spray and monitor again in a few days. However if rain is expected or crop is quite stressed then a fungicide application would be recommended.

The factors most likely to affect disease control decisions are varietal susceptibility, diseases present in the crop, whether the climatic conditions favour spread or development, crop vigour/health/nutritional status, irrigation methods, crop destination, the effectiveness of control options and, if the disease is transmitted by an insect, the population size and source of that insect.

The actual control option selected should be the option least likely to disrupt beneficial organisms, but also control the pest within certain constraints. Constraints can include product registration, withholding periods, market requirements, cost, resistance management strategies and current conditions. If a pesticide is selected, it needs to be applied using best practice spray application techniques.

Evaluation

All insect sprays should be evaluated after application. Synthetic pyrethroids, organophosphate and carbamates insecticides should show immediate effects; however, some of the newer chemistries, such as Success®, Avatar®, Chess®, and biological pesticides such as NPV and Bts can be expected to take many days to kill. Feeding usually ceases shortly after application.

Harvest assessments are recommended for the purpose of comparing crops and seasons. Spending some time each year looking at crop records to see why some plantings were more successful than others can be insightful. Records will reveal pest population trends following control measures. This will help you to learn more about the indirect effects of particular chemical applications; for example, the use of a broad-spectrum insecticide may wipe out the target insect pest as well as the beneficial insects present in the crop, which may result in a minor insect pest becoming a serious problem.

Talking to others about current conditions, crop quality and pack-outs can provide information on how you are performing relative to others, and give you ideas for ways to improve your management. Looking over records over a number of seasons may show patterns or paddock variations that you hadn't noticed previously, which will allow you to address the problem and improve your overall performance.

IPM continues to evolve as new pests arrive, new management options become available and new techniques are adopted. Over time, an IPM strategy will tend to shift effort from intervention strategies to prevention strategies.

Vegetable Resources

Keep It Clean (2009) NSW I&I Badgery Parker *et al.* Comprehensive guide for greenhouse growers that lists and describes more than 70 management practices that can significantly reduce the costs and losses that can result from pests and diseases. Useful for hydro lettuce growers or those growing their own seedlings

A series of summary fact sheets and example record sheets are also available to download. Manual can be down loaded or hard copy ordered.

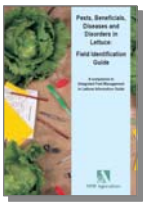
http://www.dpi.nsw.gov.au/agriculture/horticulture/greenhouse/pest-disease/general/preventing

Integrated pest management in lettuce: information guide (2002) NSW Agriculture McDougall *et al.* 150pp

Information guide provides information about IPM, what it is, recognizing and monitoring of pests, beneficials, diseases and weeds, spray application and record sheets.

http://www.dpi.nsw.gov.au/aboutus/resources/bookshop/ipm-lettuce-infoguide

Pests, beneficials, diseases and disorders in lettuce (2003) NSW Agriculture McDougall & Creek



http://www.dpi.nsw.gov.au/aboutus/resources/bookshop/ipm-lettuce-field-id-guide

Lettuce Best Practice: Integrated Pest Management (2010) Vic DPI Dimsey *et al.*

http://www.hin.com.au/Associations/HSPN/Resources/Manual-Lettuce-Ute-Guide

Chemical use

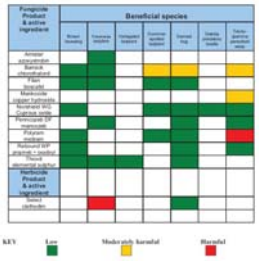
Western flower thrips (WFT) insecticide resistance management plan (2010), NSW DPI, G. Herron et al. This series of web pages gives basic information on WFT resistance management and pages of the permitted insecticides for crops.

http://www.dpi.nsw.gov.au/agriculture/horticulture/pests-diseases-hort/multiple/thrips/wft-resistance

Spray Sense – information for users of chemicals. This booklet is available from the NSW DPI bookshop or as pdf leaflets from the NSW DPI website. Spray Sense covers all aspects of chemical application from reading chemical labels, calibrating sprayers, using different spray applicators to cleaning out tanks.

http://www.dpi.nsw.gov.au/agriculture/farm/chemicals/general/spray-sense-leaflet-series

Chemical impact on beneficials



Three one-page tables detailing the effects of pesticides on beneficials

1. Insecticide effects on beneficial insects and mites

2. Insecticide compatibility with non target beneficials

3.Fungicide and herbicide effects on beneficials

www.ipmtechnologies.com.au > IPM tools> Insecticide compatibility

Monitoring tools

Handlens and yellow or blue sticky traps are available from a number of sources and may be available from your local agricultural supplier.

Or can be purchased from:

Australian Entomological Supplies:

Phone : (02) 6684 7650 Fax : (02) 6684 7188
http://www.entosupplies.com.au/

Bugs for Bugs

Phone: (07) 4165 4663 Fax: (07) 4165 4626
http://www.bugsforbugs.com.au/ipm/tools

Biological Services

Phone: (08) 8584 6977 Fax: (08) 8584 5057
http://www.biologicalservices.com.au

Sending samples for identification

Management strategies are most effective when accurate identification of a pest is made.

Insects can be identified either from specimens collected into a vial or container, or from sticky traps. If it is likely to be some time before you can deliver or send the sample then, if possible, collect insects into a small quantity of rubbing alcohol (available at the chemist). Collect at least 10 specimens as handling and transportation may damage important diagnostic features used to identify the insects. Sticky traps can be covered in plastic cling wrap before removing from the field or greenhouse. Try to avoid squashing sticky traps as accurate identification is difficult if specimens are damaged.

For plant diseases collect a number of plants showing the range of symptoms. Wrap plant material in damp but not wet paper, place in a plastic bag, keep cool and send or deliver as quickly as possible.

Samples can be left at any NSW DPI office or sent to:

Insect specimens - Delivery or Postal

Attention: Sample Submissions
NSW DPI
OAI, Forest Road, Orange NSW 2800
Ph: (02) 6391 3980

Plant specimens-Delivery

Attention: Sample Submissions
Elizabeth Macarthur Agricultural Institute
Woodbridge Rd MENANGLE NSW 2568

Or Postal

Attention: Sample Submissions

NSW DPI Elizabeth Macarthur Agricultural Institute

PMB 8 CAMDEN NSW 2570

Ph: (02) 4640 6327

[fees are charged for diagnostic services]

NSW DPI Insect pest & disease diagnostic laboratories information and submission forms: http://www.dpi.nsw.gov.au/aboutus/services/das/plant-pests-diseases

Further information

Visit the Vegetable diseases, pests & disorders section of NSW DPI website for more factsheets

http://www.dpi.nsw.gov.au/agriculture/horticulture/vegetables/diseases

or the Pests, diseases & disorders in greenhouses section of NSW DPI website

http://www.dpi.nsw.gov.au/agriculture/horticulture/greenhouse/pest-disease

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Users of agricultural or veterinary chemical products must always read the label and any permit, before using the product, and strictly comply with the directions on the label and the conditions of any permit. Users are not absolved from compliance with the directions on the label or the conditions of the permit by reason of any statement made or not made in this publication.

Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (August 2011). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the Department of Primary Industries or the user's independent adviser.

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