NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Readers' Note

Reducing the impacts of birds in horticulture

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This chapter was written by John Tracey of the Vertebrate Pest Research Unit, Orange Agricultural Institute, NSW Department of Primary Industries.
The article originally appeared in Orchard Plant Protection Guide for Deciduous Fruits in NSW 2004/05 *(Hetherington, Thwaite and Bright eds).*

Many native and introduced birds in Australia can cause significant damage to cultivated fruit, nuts, olives and grapes. The main problem species are common starlings (*Sturnus vulgaris*), silvereyes, psittacines (cockatoos, corellas, galahs), honeyeaters (Meliphagidae), rosellas (*Platycercus elegans*, *Platycercus eximius*) and corvids (crows and ravens).

Introduction

There is a diverse range of management options for pest birds, with variable effectiveness, and no single solution is applicable to all situations. The greatest crop damage is usually caused late in the ripening season, which coincides with the busiest time for growers. As a result, bird management is often not initiated until after considerable damage has

already occurred. Integrated pest management is a concept well understood for insects and disease problems, but birds are usually not managed in the same strategic way.

Rather than focusing on killing as many pests as possible, we now realise that, like most other aspects of agriculture, bird management needs to be carefully planned and coordinated. Bird control is just one aspect of an integrated approach to production management. Many birds are highly mobile and can readily replace those that are killed in control programs. Unless actions are well planned and coordinated they are unlikely to have a lasting effect. When planning bird management, there are some important steps that should be considered.

What is the problem?

In the past the pest was usually seen as the only problem. Hence the solution was to kill as many birds as possible. We now know that the situation is more complex. First, determine what is the problem. It may be reduced crop yields, secondary losses causing downgrading of fruit, complaints from neighbours, or emotional stress from worrying about the next attack. Several factors affect each of these problems, and control of birds is often only part of the solution. The following questions then help define the problem:

- Where is the problem?
- How severe is the problem?
- Will the problem change with time?

Identify the birds involved

Implementing an effective bird control program requires a basic understanding of the ecology and biology of the targeted pest species and, in some cases, those species affected directly (non-targets) or indirectly (prey species) by a control program. It is also essential to understand the impact created by the pest—that is, what is the problem? Control strategies can be targeted for particular birds. For example, some species such as silvereyes and many honeyeaters are highly migratory, moving into orchards only during specific periods. Out-of-season control may hence be inappropriate for these species.

Most birds are beneficial or desirable, and it is important that management does not affect these species. Some birds can be both beneficial and pests. Honeyeaters, for example, can become a more serious problem in orchards during seasons of poor eucalypt flowering, but also consume many damaging insects throughout the year. Other information sheets on pest bird identification,

A starling

biology, movements, habitat, feeding behaviour and the damage they cause are available from your State government department of agriculture or primary industries.

Estimate the damage caused to production

Estimating the damage and calculating the cost will give you a basis for deciding how you can best reduce the damage and how much you can afford to invest in control effort. The percentage of the crop damaged by birds in an orchard block can be estimated by randomly or systematically sampling rows, plants, and individual fruit. Bird damage to individual fruit can be estimated by counting or weighing or by using a visual estimate. Often sampling and calculating damage to the edges of a crop separately will increase the efficiency of your calculations.

Identify any key constraints

Consider legal, social and environmental issues. For example, will scare devices be acceptable to the local community? Are the techniques legally and/or environmentally responsible?

Decide on the most cost-effective time to implement the plan

Even when good information is available it is often not practicable to be immediately responsive to short-term fluctuations in bird numbers or the damage they cause. When damage becomes significant it is usually too late to implement control. For example, effective use of scaring often requires a 'start early' approach to prevent birds establishing a feeding pattern. Likewise, investment in netting can't be simply withdrawn for those seasons in which damage is

below the cost–benefit threshold. Instead, we may need to look at costs and benefits over a longer time frame and make decisions accordingly. Where damage in your area is likely to be high, or you have a history of high damage, you should be more inclined to invest in continuing management action. Measuring damage this year will help you select the optimal management option next year and beyond.

Develop the most appropriate bird management plan

Importantly, the management plan must have details of what will be done, who will do it, when it will be done and how much it will cost. Options can include individual techniques or combinations, and different levels of application. The plan must have long-term, year-to-year strategies to prevent damage, and short-term reactive strategies to cope with sudden increases in damage. For example, in the long term managers may net a small part of their crop every year, and in the short term, when damage is higher, they may also implement a scaring program.

Monitor and evaluate

Has your management been successful? Estimating damage is the most direct way you can measure the effectiveness of your management program. All costs and labour of implementing control should also be considered. For example, nets might have significantly reduced bird damage, but if they were repeatedly removed for maintenance or spraying your crop this, too, comes at a cost. What things worked; what things didn't; what can be improved for next year? Evaluating management will enable improved decision-making for future strategies. It allows you to modify your actions to maximise any economic return.

There is no one simple solution for managing birds effectively, but the following information may help you to decide on the most appropriate action for your situation.

Management options

Scaring

Many visual and sound devices have been used by managers in an attempt to scare birds. Some of these include acetylene and LPG gas guns, electronic devices, radio, flashing or rotating lights, scarecrows, reflective mirrors or tape, helium- or air-filled balloons, and predator models or kites. Habituation is the main drawback of all types of scaring. Birds quickly become accustomed to noise or visual cues. Best results for scaring are achieved when: a combination of techniques is used; scaring starts before the birds establish a feeding pattern; the sound is reinforced by shooting or a threat to shoot; and the timing and placement of devices is changed frequently, but not at regular intervals. The following suggestions may improve or prolong the effectiveness of scaring:

- Loud sounds are more of a deterrent than quiet sounds.
- Sounds with a wide frequency range are more of a deterrent than pure tones.
- Loud sounds produced by simple cheap methods are likely to be just as effective as sounds produced by expensive electronic devices.
- Devices are more effective when used for the shortest time necessary for a response.
- Adult birds are more easily scared than juveniles.
- All species habituate to nearly all sounds tested, so the effect of most sound-generating devices is short term.
- Ultrasonic devices are ineffective, as most birds can't hear ultrasound (≥ 20 kHz).
- Broadcast alarm and distress calls can be effective but are subject to similar habituation to other sounds, are species-specific, and may cause a 'mobbing' rather than an escape response.
- Birds of prey rarely call when hunting, hence pre-recorded raptor calls are likely to represent something novel to birds rather than create an avoidance response from a predator.

Birds of prey

Attracting birds of prey or using falconry is often perceived to be of value in scaring birds or reducing pest numbers. However, although falconry has been used previously in airports to reduce bird strikes, it is impractical in most situations. Falconry is strictly regulated in Australia, requires skilled handlers and considerable training, and is labour intensive.

Encouraging raptors to specific areas is difficult, as different species occupy different niches. For example, sparrowhawks and goshawks prefer hunting amongst trees and tall shrubs to surprise

prey; most falcons prefer open country; and Australian hobbies (*Falco longipennis*) prefer lightly timbered country along watercourses. The most effective predators of adult birds are also unlikely to be attracted by carrion or other food sources. Species that may be attracted (e.g. wedge tailed eagles, little eagles, whistling kites) do not normally hunt birds in flight. Some studies have shown that providing perches increases the numbers of birds of prey. However, this has not yet been demonstrated to reduce the number of pest birds or the damage they cause. More investigation is required.

Lethal control

Many attempts to kill birds, despite alleviating frustration, often do not reduce damage. The techniques used are usually labour intensive and may have legal, welfare and social concerns. Permits from national parks and wildlife agencies are required to kill most native species. Pest birds, particularly introduced species, have high population turnover rates and high rates of natural juvenile mortality. Attempts to reduce populations in the long term need to remove a greater number than are being replaced. Therefore, greater effectiveness may be achieved if the breeding population is targeted.

Traps require considerable labour and are therefore often cost prohibitive. However, trapping may be of benefit in situations where a single resident species is involved and a large proportion of the population can be trapped. A multitude of different trap designs are available, including remotely operated nets, cage and roost traps, funnel entrance traps, modified Australian crow traps, and nest box traps. The success of trapping varies according to the skill of the operator and the time of year. For example, large numbers of starlings can be captured after the breeding season, between late December and March, when many juveniles are congregating. However, this may have little long-term effect on the population size owing to the breeding potential of starlings, which can produce an average of two clutches of four chicks each season. Hence, removing birds during the breeding season (August to November) may result in fewer individuals captured but potentially create a greater reduction in population size for the summer and autumn.

Shooting is most beneficial when employed as a part of a scaring program. If regarded as a training tool rather than a method of population control, it can educate birds to associate noise with a real threat. To reduce habituation, shooting should occur at the same time scaring devices are used. This establishes a connection between the scarer and danger.

Modified Australian crow trap

Although some lethal poisons are registered for use in some States (see www.apvma.gov.au/pubcris/subpage_pubcris.shtml), their use is strictly regulated. For example, many products can be applied only for introduced species, in or around buildings and by licensed pest control operators, and they require site permits from parks and wildlife agencies.

Reducing breeding success by removing eggs or nests or applying oils to eggs has not been adequately investigated. This method may be appropriate for species that reproduce quickly, and has the advantage of reducing the need to kill large numbers of birds. Permits must be obtained for native species. Various fertility control chemicals have been reviewed for birds, but none has been sufficiently field tested, nor is any commercially available.

Orchard management and habitat considerations

A range of landscape and habitat factors influence the number of pest birds and the damage they cause. These factors can be considered when attempting to minimise losses. The varieties grown and timing of maturity can be important. For example, growing varieties that mature simultaneously can help alleviate the damage to individual growers. Depending on the birds involved, sites with adjacent roosting habitat or powerlines can have higher losses. The numbers of pest birds and the levels of damage will vary according to the preferred habitat of different species. For example, common mynas prefer urban environments; cockatoos and starlings are most abundant in cleared agricultural land and areas near cities and towns; and most native species prefer native vegetation. These factors can be considered before planting new crops.

Providing alternative food sources by decoy or sacrificial planting may be effective for some situations. This relies on knowledge of the feeding habits of the main birds involved. A decoy planting ideally will produce food of equivalent or enhanced nutritional requirements and attractiveness for birds; and is available just before, and at the same time as, your crop is susceptible to damage. For honeyeaters and lorikeets, revegetating areas with local native trees and shrubs will increase the availability of their preferred food source. This may offer a long-term solution in reducing damage and has obvious environmental benefits. Birds such as starlings that prefer insects may be attracted to irrigated areas where large numbers of insects are available. However, supplying alternative foods may also attract more pest birds to the area. Hence, for honeyeaters and lorikeets, a more regional approach to revegetation, rather than localised plantings, may be required. A scaring program is likely to be more effective if alternative food sources are available.

Netting

Exclusion netting using throw-over or permanent nets has high up-front costs but may be appropriate where high value crops are grown and levels of damage are high. A variety of netting options are available. Machines can be used to install and remove drape-over nets of varying width (e.g. one, two or four rows). 'Lock-out' netting provides a continuous cover of netting by joining draped nets without the need for poles and cables. Nets can also be used on infrastructure to prevent birds roosting or nesting. If maintained, netting with ultra-violet stabiliser can provide between 5 and 10 years of protection.

Netting overcomes the legal, environmental, social and animal welfare concerns of other techniques. The decision to net is mainly an economic one. Will the increase in returns from excluding birds be beneficial over the life of the netting? As an example, cost–benefit analysis on vineyard netting suggests that drape-over nets are cost effective when damage is consistently greater than 10% and permanent nets are cost effective when damage is over 25%. The value of the crop and the practicalities of netting must be considered.

Roosting deterrents

There are a variety of spikes, coils, and wire products that are available to exclude birds from perching on buildings and infrastructure. Electrified wires, which can be attached to the top of vineyard trellises, are also available. These wires give birds a small electric shock but do not harm them. Monofilament lines have been successful for deterring larger birds from fish farms but ineffective for deterring smaller species from fruit or nut crops.

Chemical deterrents

There are several chemical deterrent products commercially available in Australia. Check with the Agricultural Pesticides and Veterinary Medicines Authority for up-to-date registration information: www.apvma.gov.au/pubcris/subpage_pubcris.shtml and appropriate applications. Some deterrents are based on polybutene, which is a tactile roosting repellent; aluminium ammonium sulfate, which acts on the senses of smell and taste; or methiocarb, which is an insecticide that causes conditioned aversion.

Polybutene is a sticky substance that irritates the bird's feet and can prevent birds from roosting on infrastructure; hence it is applicable for buildings and urban areas. Aluminium ammonium sulfate may be applied to vegetables, nuts, fruit, orchard trees and vines, provided the guidelines on the permit are adhered to (e.g. thorough washing before consumption). Methiocarb is a secondary repellent that causes birds to become ill, creating a learned aversion of the food. This product can be applied to ornamental plants but is not recommended for edible fruit or nuts. Garlic and chilli sprays have been used to deter birds from feeding, but these are unlikely to be effective.

Summary of the main points to consider:

- Identify the bird species
  —Consider behaviour, movements and legalities
- Measure damage
  —How much are birds actually costing you?
- Use integrated control
  —Multiple techniques

For scaring, start early and use persistence, variation and reinforcement.

- Review your bird management strategy
  —Do the benefits outweigh the costs?

Sources and further reading

This information is based on national guidelines for managing pest birds, developed by the Bureau of Rural Sciences, with help from the Natural Heritage Trust and the Australasian Pest Bird Network.

Bomford M, O'Brien P (1990) Sonic deterrents in bird damage control: a review of device tests and effectiveness. *Wildlife Society Bulletin* 18, 411–422

Bomford M, Sinclair R (2002) Australian research on bird pests: impact, management and future directions. *Emu* 102, 29–45

Braysher M (1993) *Managing Vertebrate Pests: Principles and Strategies.* Australian Government Publishing Service, Canberra

Braysher M, Saunders G (2002) *Best Practice Pest Animal Management.* AgNote DAI 279. NSW Department of Primary Industries, Orange NSW

Kay BJ, Twigg LE, Nicol HI, Korn TJ (1994) The use of artificial perches to increase predation on house mice (*Mus domesticus*) by raptors. *Wildlife Research* 21, 95–106.

Sinclair R (2000) Guidelines to best practice bird control to minimise losses in vineyards. *Australian Viticulture* Mar/Apr, 60–85.

Tracey J (2004) Managing bird pests in orchards. In *Orchard Plant Protection Guide for Deciduous Fruits in NSW 2004/05*. SD Hetherington, JD Bright, WG Thwaite (Eds) pp. 2–5. NSW Department of Primary Industries, Orange NSW

Tracey J, Saunders G (2003) *Bird Damage to the Wine Grape Industry.* Report to the Bureau of Rural Sciences, Department of Agriculture, Fisheries and Forestry. NSW Agriculture, Orange NSW

Forms, schedules and resources

Mite monitoring form for Australian summerfruit

Australian Summerfruit IPDM Record Card
Two-spotted mites and predators

ORCHARDIST:
BLOCK:

Sample date	Observer	A	B	C	D	E		
		Zero mites / predators	Two-spotted mites only	Mites and predators	Predators only	Total leaves	Percentage mites	Percentage predators

Monitoring form for diseases of Australian summerfruit

Orchardist:		Block:		Season:

Sample date	Observer	Brown rot	Blossom blight	Freckle		Leaf curl		Silver leaf	Rust		Bacterial spot	Bacterial canker		Shot-hole	
		Present (✔/✘)	Present (✔/✘)	Temp	Rainfall (✔/✘)	Temp	Humidity	Present (✔/✘)	Leaves wet (hours)	Temp	Present (✔/✘)	Present (✔/✘)		Leaves with lesions (%)	Rainfall expected (•/·)
		Mid-season to after harvest	Budswell to full blossom	4-week period following shuck split		Budswell	Budswell	Mid-season to leaf fall	Mid-season to after harvest		Early budswell to mid-blossom	Early to mid-budswell	After harvest to leaf fall	Shuckfall to harvest	
Action threshold*		✔	✔	18–24 °C	✔	20–26 °C	High	✔	More than 4	13–25 °C	✔	✔	✔	5%	✔

*In all cases the action threshold can be reached only if the disease has been present in the orchard at some time during the last four seasons

Monitoring form for insect pests of Australian Summerfruit

Orchardist					Block				Season				
Sample date	Observer	**Plague thrips**	**Western flower thrips**	**Carpophilus beetles**	**Lightbrown apple moth**		**Black and green peach aphid**		**San José scale**	**European earwig**	**Oriental fruit moth**	**Fruit fly**	
		Present (✔/✘)	Present (✔/✘)		Present on weeds (%)	Leaves or fruit infested (%)	Colonies per tree (trees younger than 3 yrs old)	Colonies per tree (older trees)	Present on trees (✔/✘)	Earwigs / trap		Flies/ Lynfield trap	Fruit: presence of stings (✔/✘)
		Budswell to shuckfall	Budburst to harvest		Budswell to shuckfall	Ripening to harvest	Budswell to mid-summer		Late blossom to dormancy	Budswell to harvest		Late blossom to harvest	Mid-season to harvest
Action threshold		✔	✔		10%	3–5%	1	2	✔	5		20	✔

Useful contacts

New South Wales

Agricultural Scientific Collections Unit (ASCU)

The ASCU holds Australia's most complete collection of insect pests and diseases relevant to the agricultural industry. It offers a fee-for-service, NATA-accredited (ISO/IEC 17025 (1999)) diagnostic service. NSW Department of Primary Industries, Orange Agricultural Institute, Forest Road, Orange NSW 2800. Telephone (02) 6391 3800. Fax (02) 6391 3899.

Deciduous Fruit Pathology Laboratory (DFPL)

The DFPL offers NATA-accredited, fee-for-service diagnostics to the summerfruit industry. Orange Agricultural Institute, Forest Road, Orange NSW 2800. Telephone (02) 6391 3860. Fax (02) 6391 3899

Department of Primary Industries

The New South Wales Department of Primary Industries offers a regional extension and advisory service to the summerfruit industry through its district horticulturists, listed below.

Alstonville

Phillip Wilk
Tropical Fruit Research Station
PO Box 72
Alstonville NSW 2477
Telephone: (02) 6626 2450
Fax (02) 6628 5209
Mobile 0411 139 567

Camden

Lawrence Ullio
Elizabeth Macarthur Agricultural Institute
Menangle Road
Menangle NSW 2520
Telephone (02) 4640 6408
Fax (02) 4640 6300
Mobile 0412 436 871

Gosford

Sandra Hardy
Horticultural Research and Advisory Station
Research Road
Gosford NSW 2250
Telephone (02) 4348 1916
Fax (02) 4348 1910
Mobile 0412 425 730

Orange

Jeremy Bright
Orange Agricultural Institute
Forest Road, Orange NSW 2800
Telephone (02) 6391 3822
Fax (02) 6391 3883
Mobile 0427 213 059

Tumut

Julie Dart
64 Fitzroy Street, Tumut NSW 2720
Telephone (02) 6947 4188
Fax (02) 6947 4149
Mobile 0427 918 315

Richmond

Peter Malcolm
Building M14, Castle Road
University of Western Sydney, Hawkesbury,
Richmond NSW 2753
Telephone (02) 4588 2105
Fax (02) 4588 2159
Mobile 0412 424 628

Young

Sue Marte
Cnr Lynch and Lovell Streets
Young NSW 2594
Telephone (02) 6382 1077
Fax (02) 6382 2228
Mobile 0427 800 379

Victoria

FruitCheque

FruitCheque is a Department of Primary Industries (DPI) extension project working with the fruit, olive and nut growers to achieve best practice in their business. For further information on FruitCheque please contact Cathy Mansfield at DPI Tatura on (03) 5833 5225 or cathy.mansfield@dpi.vic.gov.au

Crop Health Services (CHS)

CHS offers a comprehensive range of diagnostic services on plant diseases and pests and will also provide management recommendations as appropriate. AS/NZS 9001:2000 quality assurance certified. 621 Burwood Highway, Knoxfield. Telephone (03) 9210 9356. Fax (02) 9887 3166.

Queensland

Plant pathology diagnostics

Christine Horlock (Plant Pathologist) and Duncan Cameron (Technical Officer), Applethorpe Research Station, PO Box 501, Stanthorpe QLD 4380. Telephone (07) 4681 6100. Fax (07) 4681 1769.

Insect identification

John Hargreaves and Peter Nimmo. Applethorpe Research Station, PO Box 501, Stanthorpe QLD 4380. Telephone (07) 4681 6100. Fax (07) 4681 1769.

Summerfruit breeding

Bruce Topp, Principal Plant Breeder. Nambour/ Maroochy Research Station. Mayers Road, Nambour QLD 4560. Telephone (07) 5444 9687.

Information and extension

Clinton McGrath, Senior Extension Officer. E-mail Clinton.Mcgrath@dpi.qld.gov.au. Ross Smith, Client Services Officer. E-mail Ross. Smith@dpi.qld.gov.au.

Tasmania

Information and extension

Horticulture Branch, Grove Research Station, 99 Pages Road, Grove TAS 7109. Phone: (03) 6266 4305 Freecall 1300 368 550

Horticulture Branch, Stoney Rise, Rundle Road, Devonport TAS 7310.

Entomology and plant pathology

TASAG ELISA Testing Services

Testing for a wide range of plant viruses, some viroids and selected bacterial pathogens in a wide range of plants and seeds by trained scientists providing authoritative, independent and confidential test results and advice. Our client-base includes private agribusinesses, commercial growers, scientists, quarantine, government research bodies and certification schemes from across the country.

Entomology contacts

Mr Lionel Hill
Rundle Road
DEVONPORT
TAS 7310
Telephone (03) 6421 7636
Facsimile (03) 6424 5142
Mobile 0418 379 726
E-mail Lionel.Hill@dpiwe.tas.gov.au

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Peter Cross
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Telephone (03) 6233 6845
Facsimile (03) 6278 2716
E-mail Peter.Cross@dpiwe.tas.gov.au

Western Australia

AGWEST Plant Laboratories

AGWEST Plant Laboratories' horticulture disease diagnostic service is a fee-for-service diagnostics laboratory under Dr Hosseien Golzar offering diagnostic services for the summerfruit industry. Department of Agriculture, AGWEST Plant Laboratories, Baron Hay Court, South Perth WA 6151. Telephone (08) 9368 3721. Fax (08) 9474 2658.

South Australia

Primary Industries and Resources South Australia (PIRSA) provides horticultural advisory services through their Loxton Research Centre, Bookpurnong Road, Loxton (Telephone (08) 8595 9100. Fax (08) 8595 9199) and the PIRSA Lenswood Centre, Swamp Road, Lenswood (Telephone (08) 8389 8800. Fax (08) 8389 8899)

State government departments of primary industries or agriculture websites

Queensland
www.dpi.qld.gov.au

New South Wales
www.dpi.nsw.gov.au

South Australia
www.pir.sa.gov.au

Tasmania
www.dpiwe.tas.gov.au

Victoria
www.dpi.vic.gov.au

Western Australia
www.agric.wa.gov.au

Useful reading

The Good Bug Book (second edition; 2002) is a valuable reference source to the beneficial organisms commercially available for biological control in Australia. It includes illustrations of many of the beneficials, as well as tables of information on their susceptibility to pesticides. It is published by Integrated Pest Management Pty Ltd for the Australasian Biological Control Association Inc. and can be purchased from the Association, PO Box 436, Richmond NSW 2753, phone (02) 4570 1331, at a cost of $35 plus postage.

Spray Sense: safe and effective use of farm chemicals (2004) The Spray Sense series was originally published as 12 individual leaflets between 1995 and 1996. Topics covered include sprayer calibration, testing for residues, storing pesticides, disposal of empty containers, how to read a label, and a number of other topics. The series has recently been updated and expanded and is available from the NSW Department of Primary Industries website www.dpi.nsw.gov.au.

Integrated Pest Management for Stone Fruits (1999) Written in conjunction with the University of California Statewide Integrated Pest Management Project. This book contains a wealth of information on managing orchards to minimise pest and disease problems. Ordering information is available at http://danrcs@ucdavis.edu[.]

Orchard Plant Protection Guide for Deciduous Fruits in NSW (2005/06; Updated annually) An annual publication of the NSW Department of Primary Industries outlining management techniques for pests and diseases in that State. A hard copy of this publication can be ordered online at www.dpi.nsw.gov.au. A pdf of the current edition is also available here.

Low-chill Stonefruit Information Kit (1998) A world-first comprehensive low-chill summerfruit information kit was produced and published by Queensland Department of Primary Industries in collaboration with NSW Agriculture in 1998. The publication, which was produced under the Agrilink information program, provides commercial and potential growers with a complete information package on growing and marketing of low-chill summerfruit. The information kit can be purchased from Queensland Department of Primary Industries and Fisheries publications.

Infopest is the Queensland Department of Primary Industries, pest management information system, aimed at consultants and veterinarians. It is a listing of all agricultural chemicals and their registered uses, supplied as a CD ROM. Contact Infopest, QDPI Animal and Plant Health Service, GPO Box 46, Brisbane Qld, 4001, phone (07) 3239 3967 for more details.

Pests of Pome and Stone Fruit and their Predators and Parasitoids (1996) is a pocket-sized field guide produced by Agriculture Victoria through its Institute for Horticultural Development at Knoxfield. This publication can be ordered from the Institute, Private Bag 15, Scoresby Business Centre, Victoria, 3176 or by phoning (03) 9210 9356.

Integrated Pest and Disease Management Calendar for Tasmanian Stone Fruit. A monitoring and control calendar for pests and diseases of Tasmanian summerfruit. The calendar is available from Anna Steinhauser and Penny Domeney, Fruit Growers Tasmania, 99 Pages Road, Grove, Tasmania, 7109. Phone: (03) 6266 4305 or 1300 368 550.

Pome and Stone Fruit Orchard Spray Guide (2003–04). Bulletin 4596. ISSN 1448–0352. A spray guide recommended specifically for use by the Western Australian deciduous fruits industry. Available at the DAWA website, www.agric.wa.gov.au[.]

Common pests of summerfruit in Western Australia. Bulletin 4585. ISSN 1448–0352. Descriptions of 17 serious insect pests of Western Australia summerfruit. This manual also includes the pests' life histories and suggested control measures.

Plant Quarantine Manual Tasmania (1997) Requirements and procedures for the import of plants, plant products, and other prescribed matter for the purpose of the *Plant Quarantine Act 1997*. Available at the DPIWE website, www.dpiwe.tas.gov.au[.]

Diseases of Fruit Crops (1993) ISSN 0727–6273. Agdex 202/633. A Queensland Department of Primary Industries publication, edited by Denis Persley. Provides good descriptions and illustrations of some of the major diseases of Australian summerfruit.

Postharvest Diseases of Horticultural Products, Vol. 1: Temperate Fruit (1989) This book contains all the information necessary to identify the major postharvest diseases, disorders and injuries of temperate fruit that can be found in the market place. As well, it gives recommendations on the management of the postharvest system, so that managers can adopt better technology and avoid many of the problems that can occur. It is set out in an easy-to-read format with colour illustrations and has concise information on control of the problems. Available from CSIRO publishing at their website, www.publish.csiro.au[.]

Spray schedules

Notes on spray schedules

The following spray schedules do not contain all of the pesticides registered for control of the specified pest or disease. In all cases the 'softest' effective pesticide option is recommended.

Chemical registrations vary from State to State and growers must ensure that their choice of pesticide is registered within their State. The 'Registered' column within the tables specifies the States in which pesticides are registered for the particular use specified, at the time of printing (December 2005). Growers are required to always check the pesticide label before application as registrations change over time. The key for the 'Registered column is:

Q = Queensland
N = New South Wales
V = Victoria
T = Tasmania
S = South Australia
W = Western Australia
Nt = Northern Territory
A = Australian Capital Territory
All States = Application as directed on the label is allowed in all Australian States and Territories

Pests and diseases have developed resistance to some of the chemicals used in the Australian summerfruit industry. Pesticides are classified according to their chemistry and mode of action. Within the following schedules, this classification (in brackets) follows the pesticide name. This allows orchardists to consider to apply pesticides in a way that will minimise the likelihood of resistance developing. In general:

- Consecutive application of pesticides within the same group should be avoided.
- For any given season, the number of pesticides applied within the same group should be minimised.

Plums

Budswell			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
San José scale	Chlorpyrifos (1B) Horticultural mineral oil	QNWA	Apply at budswell. Horticultural mineral oil (2 L per 110 L spray) may be added for control of *Bryobia* mite eggs and frosted scale. Apply at early white stage if oil has not already been applied. Apply if scales are present; otherwise, an oil spray every second year to prevent is advisable.
Shot-hole	Chlorothalonil (Y) or copper oxychloride (Y)	QNVWSNtT QNVWSNtT	Apply at early white to early blossom (1%–10%). If oil spray is to be applied, combine the fungicide with the oil and apply at early white. If no oil spray is required, apply the fungicide at early blossom.
Blossom blight	Chlorothalonil (Y) or copper oxychloride (Y)	QNVWSNtT All States	
Rust	Chlorothalonil (Y) or copper oxychloride (Y) or propiconazole (sugar plums only)	QNVWSNtT All States S	
Shot-hole	Copper hydroxide (Y) or cuprous oxide (Y) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) + copper hydroxide (Y)	All States All States All States All States	Apply as leaf growth commences in blocks of young trees where shot hole is a problem. If unchecked, shot hole may result in leaf loss and restricted growth rate.
Blossoming			
Blossom blight	Carbendazim (A) or iprodione (B) or procymidone (B) or propiconazole (C) or triforine or captan (Y) or chlorothalonil (Y) or dithianon (Y) or mancozeb (Y)	QNVWST QNVWSTA QNVST QNWST QNVWSTA All States All States QNVWST NVWST	Apply at mid to full bloom (50%–100% bloom) and again at petal fall to shuckfall. **Warning:** Resistance of blossom blight to carbendazim is widespread. This fungicide may not control the disease. If resistance is suspected, choose another fungicide. If resistance is not a problem, use carbendazim only once a season. A re-entry period of 9 days applies following application of procymidone.

Plums continued

Pest	Pesticide (Pesticide group)	Registered	Comments
Shot-hole	Chlorothalonil (Y) or dithianon (Y) or mancozeb (Y) or thiram (Y)	All States All States All States All States	If these diseases are troublesome, use one of these fungicides as the petal fall to shuckfall spray. For rust control apply chlorothalonil or mancozeb at 2-weekly intervals; or dithianon or zineb at 4-weekly intervals. Thiram is not registered for rust. A full schedule of protective sprays before shuckfall is essential for rust control. The first sprays for rust should be applied no later than mid-October. **Warning:** Mancozeb may injure Wilson plums.
Rust	Chlorothalonil (Y) or dithianon (Y) or mancozeb (Y)	All States All States All States	
Blossom blight	Chlorothalonil (Y) or dithianon (Y) or mancozeb (Y) or thiram (Y)	All States All States NVWST All States	
Rust	Zineb (Y) plus horticultural mineral oil	All States	'White oil' is recommended on the zineb label. If unavailable use horticultural mineral oil. **Warning:** Zineb may injure Wickson, Wilson and early plums.
Black peach aphid	Imidacloprid (4A) or pymetrozine (9A)	All States All States	Mainly a problem in Japanese plums. Apply as soon as infestations are seen. One application should be sufficient. Do not apply either insecticide in consecutive sprays.
European earwig	Chlorpyrifos (1B)	NWA	
Lightbrown apple moth	*Bacillus thuringiensis* (Bt) (11C)	All States	Apply at first sign of activity. Bt is best used as a program. It is not suitable for emergency treatment.
Midseason — after blossoming to ripening			
Rust, shot hole	Chlorothalonil (Y) or dithianon (Y) or mancozeb (Y)	All States All States All States	Apply 4–5 weeks after blossom. Do not delay if season is wet. Shorten intervals between sprays to 3 weeks if many infections are observed.
Rust	Zineb (Y) plus horticultural mineral oil	All States	'White oil' is recommended on the zineb label. If unavailable use horticultural mineral oil. **Warning:** Zineb may injure Wickson, Wilson and early plums. Mancozeb may injure Wilson plums.
Two-spotted mite	Propargite (14A)	All States	Mites become a problem only if predatory mites are absent. Thorough application is essential.

Plums continued

Pest	Pesticide (Pesticide group)	Registered	Comments
Rust	Zineb (Y) plus horticultural mineral oil	All States	Spray with mancozeb or zineb/oil treatment at intervals until 8 weeks after blossom. Make sure that the interval between sprays is no more than 3 weeks. Monitor your orchard for rust infection periods. The number of infection periods can be reduced by: • pruning to allow air flow • having younger trees • drip irrigation (where irrigation is used) • orchard floor management to reduce humidity. Infection periods are more common: • in hot weather, particularly if humid • where humidity is trapped in valleys. If the season is shaping up as a bad one for rust, the addition of propiconazole to mancozeb may be advisable. Propiconazole is a curative fungicide and should be mixed with a protectant fungicide such as mancozeb or zineb.
	Dithianon (Y) or Mancozeb (Y) or chlorothalonil (Y) or propiconazole (Y) in a tank mix with mancozeb (Y) or zineb (Y) (sugar plums only)	All States All States All States NVS All States	
Two-spotted mite	Propargite (14A)	QNVSWNtTA	Mites are most likely to be troublesome in trees adjacent to blocks of apples and pears that are being sprayed regularly for codling moth control. Monitor trees from 3 weeks after blossom and apply when mites are noticed. One thorough application should be sufficient. Check for predatory mites. In most seasons they will control two-spotted mite without the need to spray, provided disruptive pesticides are avoided.
Lightbrown apple moth (LBAM)	*Bacillus thuringiensis* (Bt) (11C)	All States	Maintain program if LBAM is a problem. Bt is not suitable as an emergency treatment.
	Carbaryl (1A) or indoxacarb (22A)	All States All States	If infestation warrants. Carbaryl will also control pear and cherry slug and European earwig on plums, but will disrupt mite control by predatory mites. Thorough spray coverage is required. Up to three consecutive applications of indoxacarb will give best results.
Rust (Sugar plums only)	Mancozeb or propiconazole (C) in a tank mix with mancozeb (Y) or zineb (Y) (sugar plums only) or zineb (Y) plus horticultural mineral oil 0.5 L in 100 L spray	All States NVS All States All States All States	From 8–10 weeks post-blossom continue rust sprays at intervals recommended by the manufacturer, especially if the season is wet. Propiconazole added to mancozeb will help in a bad rust year.

Plums continued

Ripening to harvest			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
Brown rot	Carbendazim (A) or iprodione (B) or propiconazole (C) or triforine (C) or captan (Y) or dithianon (Y) or mancozeb (Y)		Apply 3 weeks and again 1 week before picking is due to begin. Remove and destroy infected fruit. If weather conditions are favourable to brown rot it may be necessary to apply a further spray during the picking period. Observe withholding periods between spraying and picking. **Warning:** Do not use a fungicide for the last field spray from the same group as that to be used as a postharvest dip.
Brown rot	Dithianon (Y) or mancozeb (Y)	All States NVWST	Apply at intervals recommended by the manufacturer if rust or shot-hole is troublesome. In some cases, where the weather is dry and infection periods do not occur, it may not be necessary to spray. Monitor rust infection periods carefully.
Shot-hole	Dithianon (Y) or mancozeb (Y)	All States All States	
Rust	Dithianon (Y) or mancozeb (Y)	All States All States	
Queensland fruit fly	1) Hang male lures in orchard as indicator of fly presence. 2) Apply baits. 3) Spray with dimethoate (1B) or fenthion (1B) or trichlorfon (1B)	 QNVWS QNV (low chill) QNVWNt	Fruit fly may be a problem in more susceptible districts. See fruit fly control on page 46 for bait preparation. Splashing or spraying poison bait on to any suitable foliage around margins of the block may be all that is required to check a potential infestation as indicated by traps. Bait can also be splashed on to the lower portion of trees, but avoid contact with fruit. Repeat at weekly intervals. In susceptible areas and if traps indicate the presence of fruit fly, apply dimethoate 4 weeks, 3 weeks and again 1 week; fenthion 4 weeks, 3 weeks and again 2 weeks before harvest maturity. For trichlorfon, apply 250 mL / 100 L water product rate when stings are first observed, then weekly sprays at 125 mL product rate. Thorough coverage of fruits is essential. **Warning:** Dimethoate may damage early varieties of summerfruit.
Carpophilus beetles	1) Monitoring. 2) Sanitation. 3) Bifenthrin (3A)	All States	Regularly inspect fruit for beetle activity, especially as fruit ripens. Pick up and destroy fallen fruit. This will help to reduce breeding sites and spread of *Carpophilus* beetle, which also spreads brown rot. Spray only when beetles invade. Bifenthrin is toxic to beneficial insects and mites.

Plums continued

After harvest			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
Brown rot	Postharvest dip: iprodione (B)	All States	Include a wetting agent in the dip. Immerse fruit for 30–60 seconds (to ensure thorough wetting) as soon as possible after harvest. Iprodione controls brown rot and suppresses *Rhizopus* rot.
Rust	Zineb (Y) plus horticultural mineral oil 0.5 L in 100 L spray	All States	At least one rust spray after harvest is desirable, to keep leaves on the trees until normal leaf-fall time.
	Mancozeb (Y) or propiconazole (C) in a tank mix with mancozeb (Y) or zineb (Y) (sugar plums only)	All States NVS All States	Propiconazole added to mancozeb will help in a bad rust year (Note registration status within your State).
Shot-hole	Copper hydroxide (Y) or copper oxychloride (Y) or cuprous oxide (Y) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) and copper hydroxide (Y)	All States All States All States All States All States	Apply when leaves are falling freely.
Bacterial canker Bacterial spot			Copper sprays used for shot-hole will also help in the control of bacterial diseases
Black peach Aphid	Maldison (1B)	NVWSNtT	Mainly a problem in Japanese plums. Lateral growth may become infested in autumn. If this becomes severe it will be necessary to spray, otherwise considerable damage to buds, with premature bud burst, may result.
Dormancy			
Brown rot	Sanitation		Remove all mummies, cankers and dead shoots from trees and destroy by burning.
San José scale	Dormant oil	All States	Watch for infestation while pruning and apply oil if necessary while trees are dormant and up to budswell. Only one full-strength oil spray (3 L/100 L) should be used in any one year. **Warning:** Damage to sugar plums has been observed in some districts following application of oil at this time. If you suspect this to be the case, apply a registered product at a maximum 2 L/100 L, but only if needed. If damage occurs, contact your district horticulturist or adviser.

Peaches and nectarines

Budswell			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
Leaf curl	Chlorothalonil (Y) (peaches only) or copper hydroxide (Y) or copper oxychloride (Y) or cuprous oxide (Y) or dithianon (Y) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) and copper hydroxide (Y)	All States QNVWSNtA All States All States All States All States All States	Apply at early budswell if leaf curl is the main problem. Delay beyond mid-budswell will result in unsatisfactory leaf curl control. Leaf curl is a common disease and can seriously affect tree development, particularly in the first season of growth. Spraying newly planted trees should not be overlooked. Some formulations of chlorothalonil are also registered for brown rot. Where there is a range of copper oxychloride dosage rates, use the highest recommended amount shown on the registered label.
Shot-hole	Chlorothalonil (Y) or copper hydroxide (Y) or copper oxychloride (Y) or cuprous oxide (Y) or dithianon (Y) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) and copper hydroxide (Y)	All States (peaches) NVWSTA (nectarines) All States All States All States All States All States All States	
Brown rot	Copper oxychloride (Y) or dithianon (Y)	All States QNVWST	
Freckle	Copper oxychloride (Y) or dithianon (Y)	All States All States	
Rust	Copper oxychloride (Y) or dithianon (Y)	All States All States	
Bacterial canker Bacterial spot			Copper sprays used to control leaf curl will help to control bacterial diseases.
Leaf curl	Chlorothalonil (Y) (peaches only) or ziram (Y)	All States	Apply 7–10 days after a copper spray at budswell if leaf curl was a problem in the previous season or if weather is cold and wet.

Peaches and nectarines continued

Pest	Pesticide (Pesticide group)	Registered	Comments
Green peach aphid Black peach aphid San José scale	Horticultural mineral oil	All States	Apply thoroughly at early budswell. May be combined, if necessary, with copper oxychloride. This treatment, followed by the activity of aphid predators in spring, is an important component of the resistance management strategy for green peach aphid.
Oriental fruit moth (OFM)	Mating disruption	All States	Attach Disrupt® OFM or Isomate® OFM Rosso dispensers to trees at 500 per ha to give an even distribution through the orchard. See product instructions for more information.
Blossoming			
Plague thrips	Tau-fluvalinate (3A) (nectarines only)	QNVWS	Apply to nectarines once only between mid pink and petal fall, only if thrips are numerous. Tau-fluvalinate will affect predatory mites if present, and this could result in a two-spotted mite problem.
Oriental fruit moth (OFM)	Azinphos-methyl (1B) or	QNVWST	Apply azinphos-methyl at intervals of 3–4 weeks if pest is a problem.
	thiacloprid (4A) or	All States	Apply in a series of 3 sprays of thiacloprid (maximum) at 14-day intervals, commencing at egg hatch of a generational peak, as indicated by monitoring. Apply thoroughly to ensure complete coverage. For the remainder of the season, continue to use other control measures.
	indoxacarb (22A)	All States	Apply up to three applications of indoxacarb at 10-day intervals. Pheromone dispensers are the preferred treatment.
Blossom blight	Carbendazim (A) or iprodione (B) or procymidone (B) or propiconazole (C) or triforine (C) or captan (C) or chlorothalonil (Y) or dithianon (Y)	QNVWST QNVWSTA QNVST QNWST QNVWSTA All States All States (peaches) NWTA (nectarines) QNVWST	Apply at early bloom (1%) and at mid to full bloom. **Warning:** Resistance in brown rot to carbendazim is widespread. This fungicide may not control the disease. If resistance is not a problem, use carbendazim only once a season. See warnings on labels. There are restrictions on the number of sprays per season. A re-entry period of 9 days applies following application of procymidone.

Peaches and nectarines continued

Pest	Pesticide (Pesticide group)	Registered	Comments
Freckle	Dithianon (Y) or mancozeb (Y) (peaches) or thiram (peaches)	All States All States All States	Apply one of these fungicides at petal fall to shuckfall if these diseases are troublesome.
Rust	Dithianon (Y) or mancozeb (Y) (peaches)	All States All States	
Shot hole	Dithianon (Y) or mancozeb (Y) (peaches) or thiram (Y) (peaches)	All States All States All States	
Blossom blight	Chlorothalonil (Y) or dithianon (Y) or thiram (Y)	All States (peaches) NWTA (nectarines) QNVWST All States	Apply at early blossom (10%).
Shot-hole	Chlorothalonil (Y) or dithianon (Y) or thiram (Y)	All States (peaches) NVWSTA (nectarines) All States All States	
Green peach aphid	Pirimicarb (1A) or imidacloprid (4A) or pymetrozine (9A)	All States All States All States	The budswell oil spray and subsequent predator activity should give control, but if this spray was missed or infestation is severe, a spray may be necessary. Delay using insecticide for as long as possible as part of the resistance management strategy. Do not apply consecutive applications of any of these insecticides. Resistance to pirimicarb is already known. All three insecticides will also control black peach aphid.
European earwig	Chlorpyrifos (1B)	NWA	Earwigs can damage fruit in some districts and some seasons. Bait: Prepare according to product label. Apply bait at 5 kg/ha in spring. Spray: Apply in spring. Avoid contact with bees.

Peaches and nectarines continued

Midseason—after blossoming to fruit ripening			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
Oriental fruit moth (OFM)	Azinphos-methyl (1A) or thiacloprid (4A) or indoxacarb (22A)	QNVWST All States All States	Apply only if damage to lateral tips is obvious and/or fruit damage was severe last season. Where OFM is a major problem, use of pheromone dispensers for the full season is recommended.
Green peach aphid (GPA)	Pirimicarb (1A) or imidacloprid (4A) or pymetrozine (9A)	All States All States All States	Delay using insecticide for as long as possible as part of the resistance management strategy. Do not apply consecutive applications of any of these insecticides. Resistance to pirimicarb is already known. All three insecticides will also control black peach aphid.
European earwig	Chlorpyrifos (1B)	NWA	Apply if required.
Black peach aphid (BPA)	Pirimicarb (1A) or imidacloprid (4A) or pymetrozine (9A)	All States All States All States	Thorough budswell spraying often gives control for the season. Reinfestation from the roots may occur. When spraying GPA and/or BPA do not use consecutive applications of the same insecticide.
Rust	Chlorothalonil (Y) (peaches only) or dithianon (Y) or mancozeb (Y) (peaches)	All States All States All States	Apply if required. Chlorothalonil or mancozeb should be applied at 2-weekly intervals; dithianon may be applied at 4-weekly intervals.
Freckle	Dithianon (Y) or mancozeb (Y) (peaches) or thiram (Y) (peaches)	All States All States All States	
Shot-hole	Chlorothalonil (Y) or dithianon (Y) or mancozeb (Y) (peaches) or thiram (Y)	All States (peaches) NVWSTA (nectarines) All States All States All States	
Rust	Zineb (Y) plus horticultural mineral oil	All States	'White oil' is recommended on the zineb label. If unavailable, use horticultural mineral oil.

Pest	Pesticide (Pesticide group)	Registered	Comments
Oriental fruit moth (OFM)	Azinphos-methyl (1B) or thiacloprid (4A)	QNVWST All States	Spray again only if renewed activity of larvae is observed.
San José scale	Chlorpyrifos (1B)	QNWA	Apply when crawlers are active. **Warning:** This treatment could cause fruit marking, especially on white-fleshed peaches, when applied under hot, dry conditions.
Two-spotted mite	Bifenazate (2D) or tebufenpyrad (10A) (peaches only) or fenbutatin oxide or chlorfenapyr (13A) (peaches only) or propargite (14A)	All States QNVWST QNVWS All States All States	In most cases mite control is unnecessary because of biological control by predators, particularly the predatory mites *Amblyseius victoriensis, Typhlodromus occidentalis* and *Phytoseiulus persimilis*. In some regions two-spotted mite may become a problem because predators may only become established late. In these cases, use a spray that does not harm the predator. Two-spotted mite will breed during the winter on orchard weeds. This can be a source of infestation. Chlorfenapyr must only be used once on the same block of peaches in a season. It is toxic to *Phytoseiulus persimilis*. Bifenzate and tebufenpyrad are restricted to one application in a season. Avoid consecutive sprays between seasons.
European earwig	Chlorpyrifos (1B) (EC formulation)	NWA	Apply if required.
Lightbrown apple moth (LBAM)	Azinphos-methyl (1B) or indoxacarb (22A)	QNVWST All States	Examine trees thoroughly. Only thorough examination will reveal the pest—examine stem end of fruit in centre of trees. Azinphos-methyl can be used for emergency control, but observe 14-day withholding period. It will also control OFM and will help in *Carpophilus* beetle control. Thorough spray coverage is required. Up to three consecutive applications of indoxacarb will give best results.
	Bacillus thuringiensis (Bt) (11C)	All States	If LBAM is a regular problem, consider a program of Bt, especially if OFM mating disruption is being used.
Two-spotted mite	Bifenazate (2D) or tebufenpyrad (10A) (peaches only) or fenbutatin oxide (12A) or chlorfenapyr (13A) (peaches only) or propargite (14A)	All States QNVWST QNVWS All States All States	Two-spotted mite is likely to be a problem only if azinphos-methyl is applied for LBAM or OFM or if peaches are close to a block of apples or pears being regularly sprayed with the above insecticides. Some aphicides may also cause mite infestation. Monitor trees carefully and spray when mite build-up is noticed. One thorough application should be sufficient, but watch for re-infestation after 4 or 5 weeks. If further treatment is necessary, choose a miticide from another group. Chlorfenapyr must be used only once on the same block of peaches in a season. It is toxic to *Phytoseiulus persimilis*. Use bifenzate and tebufenpyrad only once in a season, and avoid consecutive applications between seasons.

Peaches and nectarines continued

Pest	Pesticide (Pesticide group)	Registered	Comments
Rust	Chlorothalonil (Y) (peaches only) or mancozeb (Y) (peaches only) or zineb (Y) plus horticultural mineral oil	All States All States All States	A spray at fruit ripening is necessary in orchards where rust has been a problem. It may be omitted in clean blocks. Chlorothalonil should not be applied later than 35 days before harvest because of possible phytotoxicity.
Fruit ripening to harvest			
Brown rot	Carbendazim (A) or iprodione (B) or propiconazole (C) or triforine (C) or captan (Y) or dithianon (Y) or mancozeb (Y)	QNVWST QNVWSTA QNVWST QNVWSTA All States All States NVWST (peaches) WST (nectarines)	Apply 3 weeks and again 1 week before picking. If weather conditions are favourable for brown rot it may be necessary to apply a further spray during the picking period. Remove infected fruit and destroy. **Warning:** Observe withholding periods between spraying and picking. Postharvest dipping will not give good results if control of brown rot has been poor in the orchard. An adequate spray program in conjunction with orchard sanitation is therefore important. For the last field spray, do not use a fungicide from the same group as that to be used for postharvest dipping.
Oriental fruit moth (OFM)	Azinphos-methyl (1B) or fenthion (1B) or thiacloprid (4A)	QNVWST NVS All States	If mating disruption is not in use it may be necessary to apply an insecticide. Fenthion will also control Queensland fruit fly, LBAM and wingless grasshopper. Maximum of three sprays for thiacloprid.
Queensland fruit fly	(1) Hang male lures in orchard as indicator of fly presence. (2) Apply baits (3) Spray with dimethoate (1B) or fenthion (1B) or trichlorfon (1B)	 QNVWS (nectarines) QNVW (peaches) QNV (low chill) NVW QNVWNt	Fruit stinging may start in December or early January as fruits approach maturity in districts liable to infestation. Early-maturing varieties usually escape infestation. Baiting may be the only form of control required in less susceptible districts. Repeat at weekly intervals. Apply dimethoate 4 weeks, 3 weeks and again 1 week; fenthion 4 weeks, 3 weeks and again 2 weeks before harvest maturity. A third spray of dimethoate may be required if harvest is delayed. Apply trichlorfon at 250 mL / 100 L product rate at the first sign of stings, then continue weekly at 125 mL product rate. Thorough coverage of fruits is essential. Fenthion should also control OFM, LBAM, Rutherglen bug and wingless grasshopper. Trichlorfon will also control Rutherglen bug. **Warning:** Dimethoate may damage early varieties of summerfruit, especially in coastal areas.

Peaches and nectarines continued

Pest	Pesticide (Pesticide group)	Registered	Comments
Western flower thrips (WFT)	Spinosad (5A)	All States	The danger period for inland districts is 2–3 weeks before harvest. Monitor carefully at this time. If presence of WFT is suspected or confirmed, apply spinosad at the rate for WFT on the label.
Carpophilus beetles	(1) Monitoring		(1) Regularly inspect fruit for beetle activity, especially as fruit ripens.
	(2) Sanitation		(2) Pick up and destroy fallen fruit. This will help to reduce breeding sites and the spread of *Carpophilus* beetle, which also spreads brown rot.
	(3) Bifenthrin (3A)	All States	(3) Spray only when beetles invade. Bifenthrin is toxic to beneficial insects and mites.
Oriental fruit moth (OFM)	Azinphos-methyl (1B) or thiacloprid (4A)	QNVWST All States	Spray again only if renewed activity of larvae is observed.
Lightbrown apple moth (LBAM)	Azinphos-methyl (1B) or indoxacarb (22A)	QNVWST All States	Examine trees thoroughly. Only thorough examination will reveal the pest—examine stem end of fruit in centre of trees. Azinphos-methyl may be used for emergency control, but observe 14-day withholding period. It will also control OFM and will help in *Carpophilus* beetle control. Thorough spray coverage is required. Up to three consecutive applications of indoxacarb will give best results.
	Bacillus thuringiensis (Bt) (11C)	All States	If LBAM is a regular problem, consider a program of Bt, especially if OFM mating disruption is being used.
Two-spotted mite	Bifenazate (2D) or tebufenpyrad (10A) (peaches only) or fenbutatin oxide (12A) or chlorfenapyr (13A) (peaches only) or propargite (14A)	All States QNVWST QNVWS All States All States	Keep trees under observation. Apply miticide if necessary but observe withholding periods.
After harvest			
Brown rot	Postharvest dip: iprodione (B)	QNVWSTA	Include a wetting agent in the dip. Immerse the fruit for 30–60 seconds (to ensure thorough wetting) as soon as possible after harvest. Iprodione controls brown rot and suppresses *Rhizopus* rot. **Warning:** Damage to fruit, especially red-pigmented varieties, can occur when hot or over-mature fruit is dipped.

Peaches and nectarines continued

Pest	Pesticide (Pesticide group)	Registered	Comments
Leaf curl	Copper hydroxide (Y) or copper oxychloride (Y) or cuprous oxide (Y) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) + copper hydroxide (Y)	All States All States All States All States All States	Some formulations may be applied when leaves are falling freely. Check label before use.
Shot-hole	Copper hydroxide (Y) or copper oxychloride (Y) or cuprous oxide (Y) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) + copper hydroxide (Y)	All States All States All States All States All States	
Bacterial canker Bacterial spot			Copper sprays for leaf-curl or shot-hole will also help in the control of bacterial diseases.
Dormancy			
Black peach aphid	Maldison (1B)	NVWSNtT	Infestation of lateral growth may occur in autumn. If this becomes severe it will be necessary to spray; otherwise, considerable damage to buds (with premature bud burst) may result.
Brown rot	Sanitation		Remove all mummies, cankers and dead shoots from trees and destroy by burning.
San José scale	Dormant oil		In orchards where scale is known to be present, apply oil at 2–3 L/ 100L at any convenient time when trees are dormant. Spraying before pruning is preferable, as scale may survive on prunings on the ground. In districts where this pest is a problem, an annual oil spray may be necessary. Elsewhere, an oil spray every second year is advisable, even if scale is not apparent, because once scale becomes established on trees it is difficult to control. Sprays for San José scale control should be applied dilute and very thoroughly, taking care to get good wetting of trunks, limbs and twigs and penetration of cracks and crevices in the bark. **Warning:** Apply only one full-strength oil spray (3 L/100 L) in any one winter.

Peaches and nectarines continued

Pest	Pesticide (Pesticide group)	Registered	Comments
	Sanitation: Spray with oil as above or cut down and burn		Scale can build up heavily on neglected fruit tree seedlings around orchard areas and on many ornamental trees and shrubs related to summerfruit, pome fruit and other non-related hosts, e.g. tree lucerne, osage orange, willow. It can be spread from these to summerfruit by wind or birds. Such sources of infestation should not be overlooked in areas where scale is a problem. Infested deciduous ornamentals should be sprayed with oil. Neglected fruit trees should be cut down and burnt.

Apricots

Budswell			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
Bacterial canker	Copper hydroxide (Y) or cuprous oxide (Y) or tribasic copper sulfate or a proprietary mixture of mancozeb (Y) and copper hydroxide (Y)	All States NVWST All States All States	Apply at first sign of bud movement. Repeat application 7–10 days later. Note label rate.
Freckle	Copper hydroxide (Y) or copper oxychloride (Y) or cuprous oxide (Y) or tribasic copper sulfate (Y)	All States All States All States All States	Apply at bud movement.
Shot-hole	Copper hydroxide (Y) or copper oxychloride (Y) or cuprous oxide (Y) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) and copper hydroxide	All States All States All States All States All States	
San José scale	Dormant oil		Apply when buds are swollen, but before much pink of petals shows. Very thorough dilute spraying is essential. Scales are not usually troublesome in cooler regions. Spraying with oil every second year may be sufficient to prevent infestation developing in these areas. Do not use more than one full-strength (3 L/100 L) spray in any one year.

Apricots continued

Blossoming			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
Bacterial canker	Copper hydroxide (Y) or copper oxychloride (Y) or cuprous oxide (Y)	NVWST QNVWSNtT NVWST	Apply one week after petal fall. Repeat application 7–10 days later. This spray controls the high leaf population of the bacteria in mid-late spring.
Blossom blight	Carbendazim (A) or iprodione (B) or propiconazole (C) or triforine (C) or chlorothalonil (Y) or dithianon (Y) or mancozeb (Y)	QNVWST QNVWSTA QNWST QNVWSTA NVWSTA All States NVWST	Apply at mid-full bloom (50%–100%) and petal fall. **Warning:** Resistance in brown rot to carbendazim is widespread. This fungicide may not control the disease. If resistance is suspected, choose another fungicide. If resistance is not a problem, use carbendazim only once a season.
Midseason – shuckfall to ripening			
Brown rot	Chlorothalonil (Y) or dithianon (Y) or mancozeb (Y) or thiram (Y)	NVWSTA QNVWST NVWST All States	Apply chlorothalonil or mancozeb at shuckfall and again 2 weeks later, or dithianon at shuckfall and 4 weeks later.
Shot-hole	Chlorothalonil (Y) or dithianon (Y) or mancozeb (Y) or thiram (Y)	NVWSTA All States All States All States	
Freckle	Chlorothalonil (Y) or dithianon (Y) or mancozeb (Y) or thiram (Y)	NVWSTA All States All States All States	
Rust	Chlorothalonil (Y) or mancozeb (Y)	NVWSTA All States	
Lightbrown apple moth (LBAM)	Chlorpyrifos (1B) (WG formulation)	WT	May appear close to harvest time for early varieties. Watch lower parts of the tree and spray at first sign of infestation. A further application 2 weeks later may be required.
	Bacillus thuringiensis (Bt) (11C)	All States	Spray with Bt when caterpillars are first noticed. Thorough coverage is essential. Repeat at 10–14-day intervals if required. Not suitable as an emergency treatment.

Apricots continued

Ripening to harvest			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
Brown rot	Carbendazim (A) or iprodione or propiconazole (C) or triforine (C)	QNVWST QNVWSTA QNVWST QNVWSTA	Apply 3 weeks and again 1 week before picking is due to start. Remove infected fruit and destroy. Observe withholding periods between spraying and picking. If shot-hole or freckle is a major problem, use one of the fungicides listed for those diseases.
Brown rot	Dithianon (Y) or mancozeb (Y) or thiram (Y)	QNVWST NVWST All States	
Rust	Mancozeb (Y)	All States	
Shot-hole	Dithianon (Y) or mancozeb (Y) or thiram (Y)	All States All States All States	
Queensland fruit fly	(1) Hang male lures in orchard as indicator of fly presence. (2) Apply baits (3) Spray with fenthion (1B) or trichlorfon (1B)	 NVW QNVWNt	(1) Fruit fly is unlikely to be a problem on apricots in inland districts, but fruit on coastal highlands may be attacked. (2) Splashing or spraying poisonous bait on to any suitable foliage around margins of block may be all that is required to check a potential infestation indicated by the traps. Bait can also be splashed on to the lower portions of trees, but avoid contact with fruit. Repeat at weekly intervals. (3) In susceptible areas and if traps indicate the presence of fruit fly, apply fenthion 4 weeks, 3 weeks and again 2 weeks before harvest maturity. For trichlorfon, apply 250 mL / 100 L water product rate when stings first observed, then weekly sprays at 125 mL product rate. Thorough coverage of fruits is essential.
Carpophilus beetles	(1) Monitor (2) Sanitation (3) Bifenthrin (3A)	 All States	(1) Regularly monitor fruit for beetle activity, especially as fruit ripens. (2) Pick up fallen fruit, which can attract beetles into the orchard. They spread brown rot. (3) Only when beetles invade. Bifenthrin (3A) is toxic to beneficial insects and mites.

Apricots continued

Pest	Pesticide (Pesticide group)	Registered	Comments
Lightbrown apple moth (LBAM)	Chlorpyrifos (1B) (WG formulation)	WT	May appear close to harvest time for early varieties. Watch lower parts of the tree and spray at first sign of infestation. A further application 2 weeks later may be required.
	Bacillus thuringiensis (Bt) (11C)	All States	Spray with Bt when caterpillars are first noticed. Thorough coverage is essential. Repeat at 10–14-day intervals if required. Not suitable as an emergency treatment.
Brown rot	Postharvest dip: iprodione (B)	QNVWSTA	Include a wetting agent in the dip. Immerse fruit for 30–60 seconds (to ensure thorough wetting) as soon as possible after harvest. Iprodione controls brown rot and suppresses *Rhizopus* rot.
Rust	Chlorothalonil (Y) or mancozeb (Y)	NVWSTA All States	Monitor undersides of young leaves frequently and spray as soon as any rust is observed.
Dormancy			
Shot-hole	Copper hydroxide (Y) or cuprous oxide (Y) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) plus copper hydroxide (Y)	All States All States All States All States	Apply at postharvest.
Bacterial canker	Copper hydroxide (Y) or cuprous oxide (Y) or tribasic copper sulfate (Y)	NVWST NVWST All States	Apply when leaves are falling freely, and again in mid-winter.
Brown rot	Sanitation		Remove all mummies, cankers and dead shoots from trees and destroy by burning.
San José scale	Dormant oil		Watch for infestation and treat with oil if necessary while trees are dormant. **Warning:** Use only one full-strength oil spray (3 L/100 L) in any one winter.

Low- and medium-chill summerfruit (nectarines, peaches, plums)

Early budswell to early pink / early white			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
Leaf curl	Chlorothalonil (Y) (peaches) or copper hydroxide (Y) or copper oxychloride (Y) or cuprous oxide (Y) or dithianon (Y) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) and copper hydroxide (Y)	All States All States All States All States All States All States All States	Spraying of newly planted trees should not be overlooked. Where there is a range of rates for copper oxychloride, use the highest permitted rate. Chlorothalonil is not registered for leaf curl; copper hydroxide and cuprous oxide are not registered for rust control. Leaf curl is not a problem in plums. The proprietary mixture of mancozeb and copper hydroxide is not registered for rust.
Rust	Chlorothalonil (Y) (peaches and plums) or copper oxychloride (Y) or dithianon (Y)	All States All States All States	
Shot-hole	Chlorothalonil (Y) or copper hydroxide (Y) or copper oxychloride (Y) or cuprous oxide (Y) (peaches and plums) or dithianon (Y) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) and copper hydroxide (Y)	All States (peaches and plums) NVWSTA (nectarines) All States All States All States All States All States All States	
Bacterial spot Bacterial canker	Copper oxychloride (Y)	QW	Apply at early bud movement, 7–10 days later, and (on plums only) at blossoming.

Low- and medium-chill summerfruit (nectarines, peaches, plums) continued

Mid pink / mid white to shuckfall			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
Blossom blight	Carbendazim (A) or iprodione (B) or procymidone (B) or propiconazole (C) or triforine (C) or captan (Y) or chlorothalonil (Y) or dithianon (Y)	QNVWST QNVWSTA QNVST QNWST QNVWSTA All States All States (peaches and plums) NWTA (nectarines) QNVWST	If rain is forecast and blossom blight infection is likely, apply at early bloom (1%–10%) and at mid- to full bloom. A re-entry period of 9 days applies following application of procymidone.
Plague thrips	Tau-fluvalinate (3A) (nectarines only)	QNVWS	Spray only during flowering and only if thrips are numerous. Tau-fluvalinate is toxic to predatory mites and could result in a two-spotted mite problem later.
Western flower thrips (WFT)	Spinosad (5A)	All States	WFT activity can occur during flowering but is more likely to be a problem closer to harvest. If the pest is detected early (unlikely), then apply spinosad at petal fall. Do not confuse WFT with other thrips that also infest blossoms— the control measures are different. Consult your district horticulturist/adviser if in doubt.
Lightbrown apple moth (LBAM)	*Bacillus thuringiensis* (Bt)	All States	Apply at first sign of activity. Bt is best used as a routine program. It is not suitable for emergency treatment.
Early leafing to fruit ripening			
Rust	Chlorothalonil (Y) (peaches and plums) or dithianon (Y) or mancozeb (Y)	All States All States All States	Rust sprays should start with early leaf development and continue throughout the season. This fungicide program aims to protect the leaf from infection and is the key to rust control. When rust becomes established in an orchard it is difficult to control. Thiram is not registered for rust. Chlorothalonil is not registered for rust on nectarines. **Warning:** Do not apply chlorothalonil later than 35 days before harvest because of possible phytotoxicity.

Low- and medium-chill summerfruit (nectarines, peaches, plums) continued

Pest	Pesticide (Pesticide group)	Registered	Comments
Shot-hole	Chlorothalonil (Y)	All States (peaches and plums) NVWSTA (nectarines)	
	or dithianon (Y)	All States	
	or mancozeb (Y)	All States	
	or thiram (Y)	All States	
Queensland fruit fly	(1) Trapping		(1) Hang male lures in orchard to detect fly presence.
	(2) Baiting		(2) When flies are detected, start a baiting program and repeat weekly.
	(3) Cover sprays		(3) Apply cover sprays at 6, 4, 3, 2 and 1 weeks before harvest. Thorough coverage of fruit is essential.
	Fenthion (1B) or	QNV (low chill) NVW	Cover sprays may also control LBAM, OFM, orange fruit borer and yellow peach moth if used at the highest rate specified on the label.
	Dimethoate (1B) or	QNV (low chill) NVW	Cover sprays may also control LBAM, OFM, orange fruit borer and yellow peach moth if used at the highest rate specified on the label.
	Trichlorfon (1B)	QNVWNt	Trichlorfon may be used during harvest, provided the 2-day withholding period can be observed.
Oriental fruit moth	Azinphos-methyl (1B)	QNVWST (peaches and nectarines)	Apply if damage to young lateral tips of peaches or nectarines is obvious and/or fruit damage was severe last season. These sprays usually result in a two-spotted mite problem, so they should be applied only when absolutely necessary.
	or fenthion (1B) or	NVS	
	thiacloprid (4A) or	All States	Apply thiacloprid in a series of three sprays (maximum) at 14-day intervals, starting at egg hatch of a generational peak, as indicated by monitoring. Apply thoroughly to ensure complete coverage. For the remainder of the season use other control measures.
	Indoxacarb (22A) or	All States	Apply up to three applications of indoxacarb at 10-day intervals. See label for details on timing.
	Mating disruption		The use of OFM mating disruption has not been successful in some northern regions because of attack by orange fruit borer in the absence of insecticides for OFM.

Low- and medium-chill summerfruit (nectarines, peaches, plums) continued

Pest	Pesticide (Pesticide group)	Registered	Comments
Lightbrown apple moth (LBAM)	Azinphos-methyl (1B) or	QNVWST (nectarines and peaches) QW (plums)	Monitor trees regularly. Inspect the stem end of the fruit in the centres of the trees. Azinphos-methyl can be used for emergency control, but observe the 14-day withholding period.
	indoxacarb (22A) or	All States	Thorough application of indoxacarb is essential, using up to three sprays.
	Bacillus thuringiensis (Bt)	All States	Biological control using Bt may not be effective under high pest pressure.
Western flower thrips (WFT)	Spinosad (5A)	All States	Manage ground cover to reduce WFT populations. Monitor for thrips presence. WFT is likely to be a problem in the 2–3 weeks before harvest, especially on nectarines. If the pest is detected then, apply spinosad.
Carpophilus beetles			Beetles can be a serious problem in southern regions growing medium- and low-chill varieties, but are less of a problem in the north. Follow a three-stage management strategy.
	(1) Monitor		(1) Regularly inspect fruit for beetle activity, especially as fruit ripens.
	(2) Sanitation		(2) Pick up and destroy fallen fruit. This will help to reduce breeding sites and the spread of *Carpophilus* beetles, which also spread brown rot.
	(3) Bifenthrin (3A)	All States	(3) Spray only when beetles invade. Bifenthrin is toxic to beneficial insects and mites.

Low- and medium-chill summerfruit (nectarines, peaches, plums) continued

Fruit ripening to harvest			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
Queensland fruit fly	(1) Trapping		(1) Hang male lures in orchard to detect fly presence.
	(2) Baiting		(2) When flies are detected, start a baiting program and repeat weekly.
	(3) Cover sprays		(3) Apply cover sprays at 6, 4, 3, 2 and 1 weeks before harvest. Thorough coverage of fruit is essential.
	Fenthion (1B) or	QNV (low chill) NVW	Cover sprays may also control LBAM, OFM, orange fruit borer and yellow peach moth if used at the highest rate specified on the label.
	Dimethoate (1B) or	QNVW (peaches) QNVWS (nectarines and plums)	Dimethoate may damage early varieties of summerfruit.
	Trichlorfon (1B)	QNVWNt	Trichlorfon can be used during harvest, provided the 2-day withholding period can be observed.
Two-spotted mite	Bifenazate (2D) or tebufenpyrad (10A) (peaches only) or fenbutatin oxide (12A) or chlorfenapyr (13A) (peaches only) or propargite (14A) or	All States QNVWST QNVWS All States All States	Two-spotted mite is likely to be a problem if azinphos-methyl, fenthion or carbaryl is used extensively during the season or postharvest after bifenthrin. Monitor the centres of the trees as fruit begins to ripen and spray when a build-up is noticed. One thorough application should be sufficient, but watch for reinfestation after 3 to 5 weeks. Do not rely on one chemical group. Rotate between groups to prevent resistance developing. Use one application only of bifenzate, chlorfenapyr or tebufenpyrad in any one season and avoid consecutive sprays between seasons.
	Predatory mites		An alternative treatment to the use of miticides is the use of predatory mites (*Phytoseiulus persimilis*) to achieve biological control. Some pesticides are toxic to predatory mites and must be avoided for best results. Also refer to advice provided by the mite supplier. Chlorfenapyr is toxic to *P. persimilis*.

Low- and medium-chill summerfruit (nectarines, peaches, plums) continued

Pest	Pesticide (Pesticide group)	Registered	Comments
San José scale	Chlorpyrifos	QNWA	A preharvest treatment will be required only if crawlers are active. Observe withholding periods. This treatment could cause fruit marking, especially on white-fleshed peaches when applied under hot, dry conditions. In subtropical areas this treatment is normally undertaken after harvest is completed.
Brown rot	Carbendazim (A) or iprodione (B) or propiconazole (C) or triforine (C) or captan (Y) or dithianon (Y)	QNVWST QNVWSTA QNVWST QNVWSTA All States QNVWST	Apply 3 weeks and again 1 week before picking. If weather conditions are favourable for brown rot it may be necessary to apply further sprays during the harvest period. Remove infected fruit and destroy. **Warning:** Postharvest dipping will not give good results if control of brown rot has been poor in the orchard. An adequate spray program in conjunction with orchard and packing shed sanitation is very important. This applies especially to late-maturing nectarines. Observe withholding periods between spraying and picking. For the last field spray, do not use fungicide from the same group as that to be used for postharvest dipping.
Harvest and postharvest (fruit)			
Brown rot	Postharvest dip		Include a wetting agent in the dip. Immerse fruit for 30–60 seconds (to ensure thorough wetting) as soon as possible after harvest.
	Iprodione (B)	QNVWSTA	Iprodione controls brown rot and suppresses *Rhizopus* rot.
Rust	Chlorothalonil (Y) (peaches and plums) or dithianon (Y) or mancozeb (Y)	All States All States All States	Continue a rust prevention program after harvest to prevent premature leaf fall leading to early blossoming in autumn. Early leaf fall in mid-summer exposes scaffold limbs to sunscald, killing the bark. Wood-rotting bracket fungi colonise the dead wood. Tree health and longevity of the orchard are reduced. Spray interval is dependent on rainfall. If dry, spray every 21 days; if wet, reduce spray interval to 10 to 14 days. Good spray coverage on the underside of the leaves is essential.
San José scale	Chlorpyrifos (1B)	QNWA	Apply when crawlers are active. In some seasons scale populations can rise dramatically, causing significant limb dieback and tree death. High volume application using hand wands is recommended to ensure good spray coverage.

Low- and medium-chill summerfruit (nectarines, peaches, plums) continued

Pest	Pesticide (Pesticide group)	Registered	Comments
Oriental fruit moth (OFM)	Azinphos-methyl (1B) or fenthion or thiacloprid (4A)	QNVWST (nectarines and peaches) NVS All States	Maintain treatment of peaches and nectarines if damage to lateral tips continues. Maximum of three sprays of thiacloprid.
Two-spotted mite	Bifenazate (2D) or tebufenpyrad (10A) (peaches only) or fenbutatin oxide (12A) or chlorfenapyr (13A) (peaches only) or propargite (14A) or Predatory mites	All States QNVWST QNVWS All States All States	Mites may become a problem after harvest. Two-spotted mite is likely to be a problem if azinphos-methyl, fenthion or carbaryl is used extensively during the season or postharvest after bifenthrin. Monitor the centres of the trees as fruit begins to ripen and spray when a build-up is noticed. One thorough application should be sufficient, but watch for reinfestation after 3 to 5 weeks. Do not rely on one chemical group. Rotate between groups to prevent resistance developing. In any one season, use one application only of bifenzate, chlorfenapyr or tebufenpyrad, and avoid consecutive sprays between seasons. An alternative treatment to the use of miticides is the use of predatory mites (*Phytoseiulus persimilis*) to achieve biological control. Some pesticides are toxic to predatory mites and must be avoided for best results. Also refer to advice provided by the mite supplier. Chlorfenapyr is toxic to *P. persimilis*.
Peach tree fungal gummosis *(Botryosphaeria dothidea)*	No fungicide control program has been established for this disease.		Oozing resin or gum appears on branches or trunks and from swollen lenticels. Multiple infections result in extensive cankers. Bark takes on a black and crusty appearance. Often the branches are girdled, and if complete this leads to limb or tree decline and death. Do not leave prune stubs, as they may be potential entry points for the disease. Remove winter prunings from the orchard to reduce the amount of carryover inoculum. Avoid moisture stress after harvest and maintain tree health with adequate nutrition.

Low- and medium-chill summerfruit (nectarines, peaches, plums) continued

Leaf fall			
Pest	**Pesticide (Pesticide group)**	**Registered**	**Comments**
Leaf curl	Copper hydroxide (Y) or copper oxychloride (Y) or cuprous oxide (Y) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) and copper hydroxide (Y)	All States All States All States QNSWSNtTA All States	Use of copper sprays is often required to hasten leaf fall. Apply four sprays at weekly intervals during the leaf fall period. Delay leaf defoliation if the season is wet, as early flowering may occur if temperatures are mild during late autumn and early winter. Leaf curl is not an issue in plums.
Shot-hole	Copper hydroxide (Y) (peaches and plums) or copper oxychloride (Y) or cuprous oxide (Y) (peaches and plums) or tribasic copper sulfate (Y) or a proprietary mixture of mancozeb (Y) and copper hydroxide (Y)	All States All States All States All States All States	
Bacterial spot Bacterial canker			Copper sprays will also help control bacterial diseases.
Dormancy			
San José scale	Dormant oil		Apply oil no later than early budswell. May be combined if necessary with copper oxychloride for shot-hole and bacterial spot control. Only one full-strength oil spray should be used in any one year.
Green peach aphid	Horticultural mineral oil		
Brown rot Blossom blight	Sanitation		Remove all mummies, cankers and dead shoots from trees and destroy by burning or burying.