

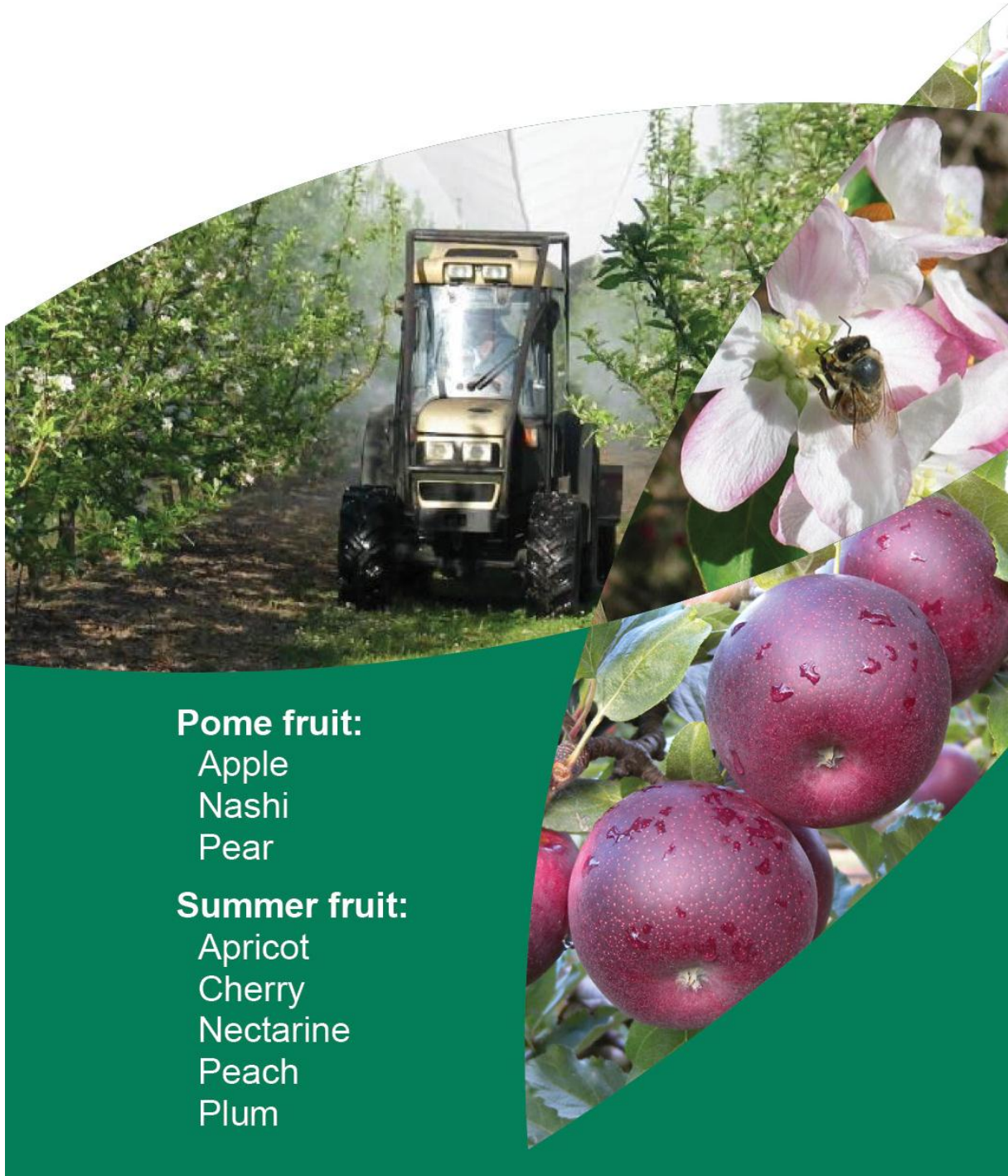


Bulletin 4861

October 2014

Replaces Bulletin 4838

Pome and summer fruit orchard spray guide 2014-15



Pome fruit:

Apple
Nashi
Pear

Summer fruit:

Apricot
Cherry
Nectarine
Peach
Plum

Supporting your success

Pome and summer fruit orchard spray guide 2014-15

Pome fruit
apple, nashi, pear

Summer fruit
apricot, cherry, nectarine, peach, plum

John Sutton, Helen Collie and Stewart Learmonth
Department of Agriculture and Food, Western Australia
Manjimup Horticultural Research Institute

The compilation of this Guide was undertaken by **Judy Rose** of the Manjimup Office of the Department of Agriculture and Food, Western Australia.

Photographs

Cover photos: Department of Agriculture and Food, Western Australia

Development stages of fruit: Shane Hetherington
NSW Department of Primary Industries

Advertisers

The Department of Agriculture and Food, Western Australia thanks the companies that have supported the production of this guide with their advertising.

This material may be reprinted provided that the article and the source and author(s) are acknowledged. Published by the Department of Agriculture and Food, Western Australia, Locked Bag 4, Bentley Delivery Centre WA 6983.

HortGuard

Key exotic threats to WA Deciduous Fruit Industry

- Apple brown rot
- Apple maggot fly
- Cherry aphid
- Cherry leaf spot
- Codling moth
- Common starling
- European wasp
- Fireblight
- Natal fruit fly
- Oriental fruit fly
- Oriental fruit moth
- Papaya fruit fly
- Queensland fruit fly
- Sharka — plum pox virus
- Silver leaf disease

'Protecting orchards is everyone's business'

Important disclaimer

The Chief Executive Officer of the Department of Agriculture and Food, Western Australia and the State of Western Australia accept no liability whatsoever by reason of negligence or otherwise arising from the use or release of this information or any part of it.

In relying on or using this document or any advice or information expressly or impliedly contained within it, you accept all risks and responsibility for loss, injury, damages, costs and other consequences of any kind whatsoever resulting directly or indirectly to you or any other person from your doing so. It is for you to obtain your own advice and conduct your own investigations and assessments of any proposals that you may be considering in light of your own circumstances.

This material has been written for Western Australian conditions. Its availability does not imply suitability to other areas, and any interpretation is the responsibility of the user.

The product trade names in this publication are supplied on the understanding that no preference between equivalent products is intended and that the inclusion of a product does not imply endorsement by the Department of Agriculture and Food, Western Australia, over any other equivalent product from another manufacturer. Any omission of a trade name is unintentional.

Inclusion of advertising in this publication should in no way be interpreted as endorsement by the Department of Agriculture and Food, Western Australia of the products and services advertised.

Always read the label — 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 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.

Parts of the chemical use pattern quoted in this publication are approved under permit(s) issued by the Australian Pesticides and Veterinary Medicines Authority and in force at the time the publication was prepared. Persons wishing to use a chemical in the manner approved under permit should obtain a copy of the relevant permit from the Australian Pesticides and Veterinary Medicines Authority and must read all the details, conditions and limitations relevant to that permit, and must comply with the details, conditions and limitations prior to use.

Recommendations were current at the time of preparation of this material.

© Western Australian Agriculture Authority 2014

Contents

	Page
1. Integrated Pest Management (IPM) and Integrated Fruit Production (IFP).....	1
2. Organic and biodynamic production Error! Bookmark not defined.	
3. Pesticide safety	4
3.1 Code of practice	4
3.2 Regulations and acts relating to use of pesticides	4
3.3 Safe handling and use of pesticides	7
3.4 Organochlorines and other chemical residues	8
3.5 Maximum Residue Limits (MRLs) and withholding periods	8
3.6 Chemical labels, permits and material safety data sheets	9
3.7 Regulation change – low risk new pesticide uses	10
3.8 Safety for bees	10
4. Pesticide application	11
4.1 Canopy spraying	11
4.2 Calibrating a boomspray for herbicide application	15
5. Pesticide resistance	16
6. Quarantine issues	18
6.1 HortGuard	18
6.2 Neglected orchards	19
7. Industry contact and technical information.....	20
7.1 Department of Agriculture and Food offices	20
7.2 Fruit industry associations in WA	21
7.3 Orchard reference material and further reading	21
7.4 Orchard industry websites	22
8. Diagnostic service—AGWEST Plant Laboratories and Pest and Disease Information Service (PaDIS)	24
9. Development stages of apple blossom.....	25
10. Pome fruit exotic pests	26

11. Apple	27
11.1 Apple pest and disease monitoring and treatment calendar	27
11.2 Apple spray options	28
12. Pear and nashi	43
12.1 Pear and nashi pest and disease monitoring and treatment calendar	43
12.2 Pear and nashi spray options	44
13. Postharvest treatments for apples and pears	57
13.1 Fungicides for storage rots	57
13.2 DPA (diphenylamine) for superficial scald	58
13.3 Calcium treatments for bitter pit	58
13.4 Other postharvest treatments: Smartfresh™	59
14. Development stages of summer fruit	60
15. Exotic pests of summer fruit	61
16. Summer fruit	62
16.1 Summer fruit pest and disease monitoring and treatment calendar	62
16.2 Summer fruit spray options	63
17. Postharvest treatments for summer fruit	85
18. Herbicide guide for deciduous orchards in WA	86
19. Example of a spray diary.....	90

Note: In the spray option tables, if an active ingredient has five or more trade names for a registered use then the Common trade names listing defaults to 'Various'. Check with your chemical supplier for a registered product.

1. Integrated Pest Management (IPM) and Integrated Fruit Production (IFP)

Integrated Pest Management (IPM) is a pest management system that aims to identify and prevent pest populations from reaching economically damaging levels. Control options may include biological, cultural, physical or chemical methods. IPM requires correct pest identification, understanding of pest biology and the damage that each pest causes. The system is a decision making process based upon monitoring, established thresholds, timing of the control measure for maximum efficiency and assessment of the results obtained. Therefore chemical control is only used if, when and where required. The outcome is a decrease in chemical use, higher number of beneficial insects, less resistance to chemicals and lower residue levels. The long-term sustainability of existing control measures also increases. The Department of Agriculture and Food, Western Australia (DAFWA) conducts IPM courses for orchardists; contact Stewart Learmonth, Manjimup Horticultural Research Institute (MHRI), Tel: +61 (0)8 9777 0000.

Integrated Fruit Production (IFP) is the adoption of economically, environmentally and socially sustainable practices in the production of fruit. Such practices would be expected to be implemented from site selection for an orchard, through fruit production to postharvest handling. A draft of guidelines for IFP in apples has been produced — Horticulture Australia Limited project AP98062 National Integrated Fruit Production Guidelines for Pome Fruit, Chief Investigator, David Williams, Department of Primary Industries, Tatura, Victoria. Available from Horticulture Australia website horticulture.com.au.

2. Organic and biodynamic production

Major markets want organic products

Multi-billion dollar organic markets are a rapidly expanding sector of the food industry in the USA, European and Asian countries and Australia. Worldwide markets for organic foods were estimated to be worth near US\$75 billion (2013) and continue to expand. The main markets are USA (US\$34 billion 2013) and the European Union (EU) countries (US\$31 billion). The large USA market continues to expand at 11.5% per year with mainstream retailers and food service driving growth. Emerging Asian markets are growing strongly with China valued at \$US 2.3 bill in 2013. The Australian organic market was estimated to be worth \$1.3 billion in 2012.

What is modern organic and biodynamic farming?

Modern **organic farming** is a whole-farm management system where natural biology and balanced soils are developed to give sustainable yields without synthetic chemicals or forced growth. **Biodynamic farming** is a specialised form of organic farming based on indications from its founder Rudolph Steiner.

Successful organic farmers design whole-farm integrated management strategies to optimise the interaction between different farm activities. Close observation and understanding of biological processes, together with good management, substitute for high amounts of synthetic chemical and fertiliser inputs.

Balanced biologically active soils, with enhanced organic matter content and humus formation, are the basis of sustainable organic farming. Maintaining good soil structure

allows crop roots to exploit large volumes of soil for moisture, air and nutrients. Soil biological processes regenerate soil fertility and release nutrients for plant uptake without the use of highly soluble fertilisers.

Integrated weed control without the use of herbicides and with timely management gives good results. Techniques for orchards can include soil improvement, cover cropping, green manuring, timely mowing, and mechanical cultivation. Pest and disease management also relies on an integrated approach to minimise vulnerability to pest or disease problems. Healthy balanced plant growth tends to be resilient to attack. Good orchard hygiene is important. A wide range of permitted substances is now available that can be used to supplement preventative integrated pest management.

Consumers care about production methods

In the highly differentiated food markets of Europe, Asia, North America and Australia consumer demand is growing for food and agricultural products that are perceived to be safe, healthy and have low impact on the environment. Willingness to pay a premium for such products is apparent where products carry a verifiable assurance they are safe, nutritious and produced using systems that care for the environment. Products certified as Organic or Biodynamic are increasingly perceived as providing such assurances.

Certified organically grown — production, processing and labelling standards

Australia has a well-regulated system for organic and biodynamic production and processing that has gained a good international reputation. The 'National Standards for Organic and Biodynamic Produce' administered by the Federal Department of Agriculture (DAF), form the minimum mandatory requirements for export of products labelled as 'organic' or 'biodynamic'. These standards are implemented by a number of independent DAF accredited organic certification organisations, which conduct farming system inspections and ensure a comprehensive record keeping system is in place to allow traceback and verification of inputs used, management practices, yield and sales.

Contact details of the DAF-accredited organic certification organisations can be found at the website agriculture.gov.au/biosecurity/about/contact/aco

Interested growers or processors should contact the above organisations to discuss the criteria for organic or biodynamic certification, specific certification needs, export market destination requirements, the costs, procedure and timing before certification can be granted.

Australia already exports organic products

The Australian organic industry was valued at almost \$1.3 billion in 2012 and continues to develop and expand into mainstream markets. Good opportunities exist to capture a share of expanding markets. The main organic or biodynamic products from Western Australia include fruits, vegetables, grains, meats, wine, olive oil and an increasing range of processed products.

Expanding opportunities with a sustainable direction

Modern organic or biodynamic farming is one way to ensure your farming system satisfies the safety, health and environment demands of many consumers. Western Australia has a number of experienced, practical, organic and biodynamic orchardists with expanding market opportunities, who are willing to promote the development of best practice in modern organic farming systems.

The Department of Agriculture and Food, Western Australia provides a range of information and support to assist organic producers and supply chain partners to develop the production and processing systems required to meet the demands of expanding organic markets.

Further reading

See the Department of Agriculture and Food website at <https://www.agric.wa.gov.au/food-export-investment/food-beverages/organic-food-farming>

For further information contact:

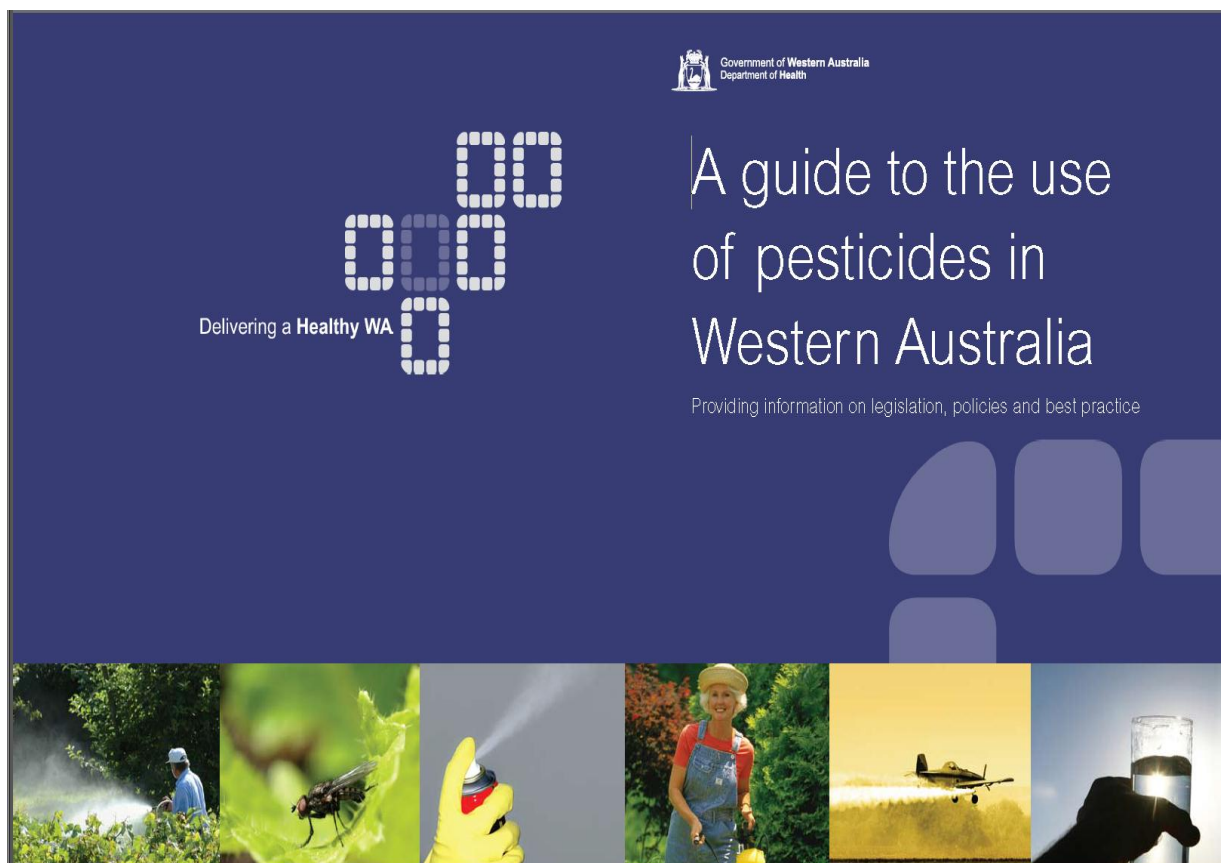
Steven McCoy
Organic Food and Farming Development
Department of Agriculture and Food, Western Australia
3 Baron-Hay Court
South Perth WA 6151
Tel: +61 (0)8 9368 3960
Fax: +61 (0)8 9368 7389
Email: steven.mccoy@agric.wa.gov.au

3. Pesticide safety

Many national and state government bodies, and private enterprise groups, are involved in managing a range of issues relating to the safe use of pesticides. The following information includes the areas of responsibility and contact details for them.

3.1 Code of practice

The booklet, 'A guide to the use of pesticides in Western Australia' provides information on legislation, policies and best practice.



The above guide can be found at the following link,
health.wa.gov.au/publications/documents/11627_Pesticides.pdf

The following information includes the areas of responsibility and contact details for Western Australian government agencies:

3.2 Regulations and acts relating to use of pesticides

Department of Agriculture and Food, Western Australia

- regulates some aspects of the use of pesticides and veterinary medicines in agriculture, including the management of residue affected land and produce
- provides information on the control of pests and diseases in animals and plants
- regulates the control of declared plants and animals in agricultural and pastoral lands.

Legislation:

Agriculture and Related Resources (Spraying Restrictions) Regulations 1979

Aerial Spraying Control Act 1966 (and Regulations)

Biosecurity and Agriculture Management (Agriculture Standards) Regulations 2013

Biosecurity and Agriculture Management Act 2007

Department of Agriculture and Food contacts:

Head Office

Tel: +61 (0)8 9368 3333

Fax: +61 (0)8 9474 2408

Email: enquiries@agric.wa.gov.au

Website: agric.wa.gov.au

Department of Health

- regulates the safe use of pesticides through the Health (Pesticides) Regulations 2011, where it affects human health
- regulates the supply and use of poisons through the Poisons Act 1964
- licenses pest management technicians and registered businesses
- provides some training and guidelines for the pest management industry
- provides information and advice on public health control programs
- provides toxicological advice on the human health aspects of pesticides

The Department of Health works closely with WA local governments and environmental health officers.

Legislation:

Health (Pesticides) Regulations 2011

Health Act 1911

Poisons Regulations 1965

Poisons Act 1964

Department of Health contacts:

Environmental Health Directorate

Tel: +61 (0)8 9388 4999

Fax: +61 (0)8 9388 4902

Email: ehinfo@health.wa.gov.au

Website: health.wa.gov.au

Department of Environment Regulation

- regulates waste management sites, contaminated sites, air and water quality, illegal discharge and pollution, under the environmental protection act 1986
- regulates pesticide manufacturing facilities
- regulates the transport of liquid chemical wastes including pesticide wastes
- investigates and may take enforcement action if there is evidence of an inappropriate pesticide application which has caused environmental harm or there has been a pesticide spill which has or may cause pollution or environmental harm
- provides guidance on chemical storage and disposal.

Legislation:

Environmental Protection (Unauthorised Discharges) Regulations 2004

Environmental Protection (Controlled Waste) Regulations 2004

Environmental Protection Act 1986

Environmental Protection Regulations 1987

Swan River Trust Act 1988

Department of Environment Regulation contacts:

Head Office

Tel: +61 (0)8 6467 5000

Fax: +61 (0)8 6467 5562

Email: info@der.wa.gov.au

Website: der.wa.gov.au

Department of Water

- protects existing and future public drinking water source areas (PDWSAS) these include underground water pollution control areas, water reserves and catchment areas
- provides guidance on land use compatibility in PDWSAS
- provides guidance on chemical storage, handling and disposal in PDWSAs.

Legislation:

Metropolitan Water Supply Sewerage and Drainage Act 1909

Rights in Water and Irrigation Act 1914

Country Areas Water Supply Act 1947

Department of Water contacts:

Head Office

Tel: +61 (0)8 6364 7600

Fax: +61 (0)8 6364 7601

Email: drinkingwater@water.wa.gov.au

Website: water.wa.gov.au

Department of Commerce (WorkSafe Division)

- regulates the workplace to ensure the safety and health of people at work
- responds to requests to investigate possible breaches of the legislation
- provides information to employers and employees on occupational safety matters
- promotes awareness of occupational safety matters to the community.

Legislation:

Occupational Safety and Health Act 1984

Occupational Safety and Health Regulations 1996

WorkSafe contacts:

Head Office

Tel: 1300 30 78 77

Email: online@commerce.wa.gov.au

Website: commerce.wa.gov.au/index.htm

Department of Mines and Petroleum

- regulates the storage, handling and transport of dangerous goods to minimise the risk to people property and the environment
- responds to dangerous goods incidents and emergencies
- investigates possible breaches of the legislation
- contributes to the development and implementation of national dangerous goods safety policy and legislation
- provides information and promotes awareness of dangerous goods safety matters to industry, government and the community.

Legislation:

Dangerous Goods Safety Act 2004

Dangerous Goods Safety Regulations 2007

Department of Mines and Petroleum contacts:

Head Office

Tel: +61 (0)8 9358 8001

Fax: +61 (0)8 9358 8000

Email: dgsb@dmp.wa.gov.au

Website: dmp.wa.gov.au

Chemistry Centre Western Australia

- provides chemical analytical support to the government, industry, academia and the community
- conducts research into chemical analytical methods
- provides advice on the chemistry of pesticides and other chemicals, and how they behave in soil, water, air and other substrates
- assists other government agencies with the management of chemical spillages, residues in foods and environmental contamination.

ChemCentre contacts:

Head Office

Tel: +61 (0)8 9422 9800

Fax: +61 (0)8 9422 9801

Email: enquiries@chemcentre.wa.gov.au

Website: chemcentre.wa.gov.au

3.3 Safe handling and use of pesticides

ChemClear

This chemical industry organisation collects unwanted rural chemicals by providing a safe and easy collection and disposal service for all chemical users within Australia.

Website: chemclear.com.au.

DrumMuster

A chemical industry organisation, in conjunction with cooperating local councils, that provides a pesticide container disposal service. Website: drummuster.com.au.

AgSAFE

Accreditation and Training program applies to the safe storage, handling, transport and sale of agricultural and veterinary chemicals from the place of manufacture through to the point of sale. Website: agsafe.com.au/agsafe.

AusChem Training WA

AusChem Training WA's range of chemical use courses is designed to raise the skills, knowledge and competence of agricultural and veterinary chemical users in WA who are managing pests and weeds in the production of food and fibre, or in the broader environment.

AusChem Training WA provides essential training courses in the selection, handling, application and disposal of agricultural and veterinary chemicals. Current AusChem Training WA accreditation is required for many quality assurance programs.

Tel: +61 (0)8 9368 3323
Fax: +61 (0)8 9368 3713
Email: office@auschemwa.com.au
Website: auschemwa.com.au

3.4 Organochlorines and other chemical residues

Orchards and old orchard sites are often contaminated with organochlorine pesticides such as dieldrin, heptachlor and DDT, which break down slowly in the soil. There is a danger that grazing animals, particularly cattle and poultry, will become contaminated with these pesticides and have meat and/or eggs high in residues. Areas of old orchard or old orchard land that may have been replanted and may be grazed by cattle, sheep or poultry can be tested to determine if there is a contamination risk from grazing them.

In addition to the risk posed by organochlorines, there may be risks to grazing animals of residues from other pesticides that were used in the past or are still being used for pest control in the orchard. Some examples of pesticide risk include poultry feeding on contaminated weevil adults or on baits used to manage snails, European earwigs or wingless grasshoppers.

Consult a biosecurity officer from the nearest office of the Department of Agriculture and Food for any queries on pesticide residue risks to grazing animals.

3.5 Maximum Residue Limits (MRLs) and withholding periods

Use of agricultural chemicals may leave residues on fruit. The level of residue that remains at harvest depends on the chemical, the formulation, the application rate, method of application, time and number of treatments, use of adjuvants, the interval since the last application and climatic conditions.

Limits for these residues are determined in various countries by health authorities. These limits are called **Maximum Residue Limits** (MRLs) and are set to ensure correct use of pesticides (Good Agricultural Practice) and to prevent consumers from taking in excessive residues. Orchardists have the responsibility to ensure that fruit they sell does not exceed MRLs for the chemicals they apply.

The **withholding period** for a particular pesticide is the minimum time between when the crop is last sprayed and when it is picked. This withholding period may vary for different crops. A withholding period of seven days means that the grower must wait for seven days between the last application of the pesticide before the crop is picked. Growers applying chemicals at the correct rate and observing the withholding period before harvest should produce fruit with residues lower than the MRL for Australia.

Orchardists involved in production of fruit for export should be aware that other countries may have different or no MRLs for chemicals used in Australia. If the importing country has a lower MRL than the Australian MRL, longer withholding periods or changed rates of application may be necessary. If the importing country has no MRL set for a chemical used in Australia, that chemical should not be applied to the crop as any detectable residue on the fruit will be unacceptable.

Growers exporting fruit should contact their exporter or industry body before spraying to ensure that MRLs in the export markets are not exceeded. For apples, check the Apple and Pear Australia Limited website apal.org.au. For summer fruit check with your exporter.

3.6 Chemical labels, permits and material safety data sheets

Chemical labels — A chemical label is a legally binding document. To use a product other than in the manner specified on the label is permitted only in situations described as 'low risk use'. See Section 3.7 for details.

Permits — In special cases a product may be used in a manner different to that specified on the label by obtaining a '**permit**' from the Australian Pesticides and Veterinary Medicines Authority (APVMA). Various types of permits are available:

- Permit to export unapproved active constituent or unregistered product.
- Permit where a previous assessment remains valid (renewal).
- Permit for minor use.
- Permit for emergency use.
- Permit for research or other miscellaneous permit.

In the section on Spray options for the various commodity groups, some chemicals listed for use in WA orchards are under an APVMA permit for minor use. For such chemicals, the permit number and expiry date are listed in the comments column. Copies of permits for minor use are available from the website apvma.gov.au.

For enquiries on a permit for minor use contact:

Australian Pesticides and Veterinary Medicines Authority
 PO Box E240 Kingston ACT 2604
 Tel: +61 (0)2 6210 4700
 Email: contact@apvma.gov.au
 Website: apvma.gov.au

Material Safety Data Sheets (MSDS) — are available for each chemical to supplement the information provided on the label. They are not part of, nor a substitute for, the chemical label. **Any farm chemical handled or stored on a property must have an up-to-date MSDS available on the premises in a known location.** The Occupational Safety and Health Regulations 1996 require that an MSDS be supplied at the first sale of a hazardous chemical and thereafter upon request. The MSDS of a chemical must be shown to any persons employed on that property, prior to using the product.

These sheets are available from chemical company websites. One website that stores a large number is MSDS Australia at msds.com.au.

3.7 Regulation change – low risk new pesticide uses

As published in the *WA Government Gazette*, 1 February 2011 No. 14, The Health Department of WA has modified the Health (Pesticides) Regulations 1956 to provide a more flexible approach for agricultural pesticide use, particularly in relation to low risk uses.

These amendments relate to Regulation 87 of the new regulations that allow the following practices, **in agricultural situations only**:

- Use of a pesticide for an unspecified pest on a registered crop.
- Use of a pesticide at a lower frequency than that shown on the label.
- Use of a pesticide at a lower rate of application than that shown on the label.
- Use of a pesticide for a crop/pest combination registered in another jurisdiction, provided the pesticide is registered for use in Western Australia and the label does not prohibit the use in Western Australia.

The Health (Pesticides) Regulations 2011 have been published in the *Government Gazette* and a copy of the new regulations is available on the following link:

[slp.wa.gov.au/gazette/gazette.nsf/gazlist/C3A3F5EE85423DDB482578260025339E/\\$file/gg014.pdf](http://slp.wa.gov.au/gazette/gazette.nsf/gazlist/C3A3F5EE85423DDB482578260025339E/$file/gg014.pdf)

See page 349, Regulation 87. Use in accordance with label.

For any queries on this contact:

Chris Sharpe, Chemical Coordinator
Department of Agriculture and Food, Western Australia
Locked Bag 4 Bentley Delivery Centre WA 6983
Tel: +61 (0)8 9368 3815
Mob: +61 (0)427 193 838
Fax: +61 (0)8 9474 2408
Email: chris.sharpe@agric.wa.gov.au

3.8 Safety for bees

An important component in helping fruit set is the use of imported honey bee hives. The survival of honey bees in a system where pesticides are relied upon for managing orchards can be helped if knowledge of pesticide toxicity is used to minimise adverse effects.

Bees actively foraging on flowers either in the crop or on ground covers may be adversely affected by pesticide applications. The type and time of application of pesticides will influence the level of bee kill. Some pesticides have very low toxicity to bees and are able to be applied even when the bees are foraging. Other short-term residual pesticides will be safe to bees if applied in the evening or at night when the bees are not foraging. More persistent pesticides may remain toxic to bees well after application.

Foraging bees may bring pesticide-contaminated pollen or nectar back to the hive. This is fed to the house bees, which in turn feed the larvae and queen. In this way the whole colony may be killed.

Symptoms of bee toxicity vary:

- There may be a sticky mass of bees dying in front of the hive.
- Bees may move very slowly.
- Bees may exhibit strange and aggressive behaviour.

One particularly toxic pesticide is the insecticide carbaryl. Not only is it very toxic to bees when applied, but carbaryl-contaminated pollen may remain toxic for up to eight months when stored in the hive.

Food safety

Apiarists in districts where orchards are located in forest areas will be sourcing honey from eucalypts. In some instances the bees from these forest-based hives will be attracted to ground flora (weeds) and this nectar will be collected and stored as honey within the hive and harvested and sold for human consumption. Sub-lethal levels of chemical can enter the food chain in this way.

Be aware of the bee toxicity rating of any pesticide used and whether hives are located near the orchard. If this is the case, please advise apiarists before chemicals are applied.

Further reading

The Rural Industries Research and Development Corporation (RIRDC) has published a book on the toxicity of pesticides to honey bees: *Honey bee Pesticide Poisoning - A risk management tool for Australian farmers and beekeepers*.

This book enables beekeepers and farmers to identify pesticides that are toxic to bees, and provides information that will help them manage the risk of honey bee poisoning. It also contains a number of useful forms, contact details and other relevant information.

This publication can be purchased from RIRDC for \$45.00 or is available as a pdf document on their website rirdc.infoservices.com.au/items/12-043.

4. Pesticide application

4.1 Canopy spraying

The good work of monitoring for pests to decide on the need for and timing of pesticide application, and correct selection of a pesticide to control the pest, will be negated by poor application technique. When using pesticides to control pests and diseases, and herbicides to control weeds, it is essential that these be applied safely and effectively.

Incorrect spray application can result in major pesticide wastage or phytotoxicity. Pesticide wastage or over-spraying may result in residues that exceed the maximum residue limit (MRL), is costly and detrimental to the environment.

Correct calibration of a sprayer is essential to apply the chemical at the label rate and to get maximum efficiency of coverage of the target.

Some principles of good spray application are:

- **Sprayers should be calibrated correctly at least once per season – best done at the start of the season.**
- The main factors affecting good spray application are **air volume and direction, tractor speed and droplet size.**
- The objective is to **replace the air in the canopy** with droplet-laden air from the sprayer. Placing balloons on the far side of the row and checking that they move when the sprayer is driven past will indicate if replacement of air is occurring.
- The **ground speed** of the tractor and sprayer has to be selected so that the air in the canopy is completely replaced.
- **The aim is to select nozzles and an operating pressure to maximise the droplet spectrum in the range 70–250 microns. More than 50 per cent of the droplets should be in this range for canopy spraying.**
- **Measure the outputs from each individual nozzle. Replace any nozzle that varies more than 10 per cent from the manufacturer's specifications.**
- Maintain records **of calibrations, which will include such details as the different blocks, tractor speed, nozzle configurations and pump pressure for future reference.**

4.1.1 Choice of equipment

Several factors may influence your choice of equipment. A sprayer should be selected which is suited to the size and density of the crop to be sprayed.

Equipment presently available includes airblast (both low profile and tower), airshear and controlled droplet application (rotary atomiser) types. These all have advantages and disadvantages.

Low profile airblast sprayers are currently the most widely used sprayers. It is important to note that a low profile sprayer's efficiency is reduced in the top section of trees greater than 5 metres high.

Besides the sprayer, the other important choice is the nozzles. As mentioned, it is important to achieve at least 50 per cent of the droplets in the range of 70–250 microns. Droplets smaller than 70 microns are highly susceptible to loss through evaporation and drift. Droplets greater than 250 microns are highly susceptible to loss through run-off. The workshop manual, 'Efficient pesticide use in orchards,' available from the Manjimup Horticultural Research Institute contains tables of the different spray nozzles used and their droplet spectrums at selected operating pressures.

The above information was part of a three-year research project, *Pesticide reduction in pomefruit towards 2000* (Project AP 97011). This was funded by Horticulture Australia Limited (HAL) and the Apple and Pear Australia Limited (formerly AAPGA) in association with the Queensland Department of Agriculture, Fisheries & Forestry (formerly Department of Primary Industries).

4.1.2 Application volume

High volume (dilute) spraying has been the conventional application strategy in pome and summer fruit orchards. In recent years more growers are adopting low volume (concentrate) spray application in their orchards. The advantages of low volume spraying include:

- reduced pesticide wastage through less run-off
- reduced spraying time (less tank refills)
- potential to use lower pesticide rates.

Important considerations when choosing low volume spraying include:

- accurate sprayer calibration is essential (less margin for error)
- pesticide labels must be interpreted correctly
- many pesticide labels specify high volume application only.

Research supports the use of low volume application in apples and pears. The final report of the Horticulture Australia Limited project *Improving spray application in apples and pears* (Project AP 95026) by Peter G Cole, David A Riches and Helen French, clearly demonstrates the advantages and disadvantages of low volume spraying.

A. To calculate the **high volume** application rate use the following formula:

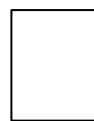
$$\text{Litres/hectare} = \frac{\text{Tree row volume}}{1000} \times \text{Spray volume factor}$$

To do this calculation you must first understand some of the terminology.

TRV (cubic metres) = Tree Row Volume = amount of tree canopy per hectare

For a vase tree the TRV = tree height (m) x tree width (m) x length of row per hectare (m)

Vase tree is assumed to be rectangular



Central leader tree is assumed to be triangular



For a **central leader tree** the TRV is only half that of a vase tree.

$$\text{The length of row per hectare (m)} = \frac{10,000}{\text{row spacing (m)}}$$

Row spacing (m)	Length of row per hectare
4	2,500
4.5	2,222
5	2,000
5.5	1,818
6	1,667

SVF = Spray Volume Factor = the number of litres of spray retained by 1000 cubic metres of canopy when it is sprayed to the point of run-off.

SVF was developed by Shell Chemical Aust. Pty. Ltd.

SVF for deciduous trees

Dormant	=	75 L
Light foliage	=	100 L
Medium foliage	=	125 L
Dense foliage	=	150 L

Example

Calculation of the litres of spray required per hectare for **high volume application**, for vase trees.

Tree height (m)	=	3
Tree width (m)	=	2
Row width (m)	=	5
SVF (medium foliage)	=	125

Step 1 TRV (m^3) = Tree height x tree width x length of row per hectare
 = $3 \times 2 \times \frac{10,000}{5}$
 = $12,000\text{m}^3$ per hectare

$$\begin{aligned} \text{Step 2} \quad \text{Litres/hectare} &= \frac{\text{TRV}}{1000} \times \text{SVF} \\ &= \frac{12,000}{1000} \times 125 \\ &= \mathbf{1500 \text{ litres per hectare}} \end{aligned}$$

B. To calculate the **low volume application rate:**

For low volume the amount of water used per hectare is decreased by a factor, for example by half, but the amount of product applied per hectare is the same. If the application volume is halved it is referred to as **2 x concentrate**. In the example, if we went from high volume at 1500 litres per hectare to 2 x concentrate we would apply only 750 litres per hectare. If the pesticide label states a rate of 1 kg/ha then at the high volume application rate the 1 kg of product would be added to 1500 litres of water. If the same product was applied at 2 x concentrate (i.e. 750 L/ha) then the 1 kg of product would be added to only 750 litres of water.

The registration of most chemicals has been done using high volumes. In other words, the rate is expressed as an amount per 100 litres and the manufacturer recommends that the spray is applied to the point of run-off. **To be eligible to use low volume application the label must quote a rate per hectare or at least specify that it can be used as a concentrate spray.**

For low volume spraying to become more widely adopted it will require the registration trials for new pesticides to include low volume applications to determine the performance of the product under such conditions. Growers also need to be well informed on low volume spraying as there is less margin for error in applying concentrated pesticides with low water volumes. Nozzles and spray heads must be accurately calibrated for the canopy size and shape, chemical and water rates must be properly calculated and pesticide labels must be interpreted correctly to ensure the appropriate rate is applied.

4.2 Calibrating a boomspray for herbicide application

To calculate the output of your boomspray use the following steps:

1. Determine ground speed.

Select a suitable gear and engine revs. Record the time taken to travel 100 metres.

Use the following formula to calculate the speed in km/h:

$$\begin{aligned}\text{Speed (km/h)} &= \frac{\text{Distance (m)} \times 3.6}{\text{Time (sec)}} \\ &= \frac{100 \times 3.6}{90} \\ &= 4 \text{ km/h}\end{aligned}$$

2. Measure nozzle output.

Set the pump pressure. A pressure below 200 kPa will reduce spray drift. Measure the output of each nozzle for one minute.

Any nozzle that varies by more than 10 per cent from the average output should be replaced.

3. Measure the effective spray width of the boom.

4. Use the following formula to calculate the output in litres per hectare.

$$\text{Sprayer output (L/ha)} = \frac{600 \times \text{Total output of all nozzles (L/min)}}{\text{Spray width (m)} \times \text{Ground speed (km/h)}}$$

Note: 600 is a conversion factor which converts km/h to m/min and L/min to L/ha.

Example

Total output of nozzles = 3 L/min (3 x 1.0 L/min)

Spray width = 1.5 m

Ground speed = 4 km/h

$$\begin{aligned}\text{Sprayer} &= \frac{600 \times 3}{1.5 \times 4} \\ &= \mathbf{300 \text{ L/ha}}\end{aligned}$$

5. Pesticide resistance

What is pesticide resistance?

Most pest and disease populations have a very small number of individuals that are resistant to a given pesticide. Frequent use of the same pesticide kills susceptible individuals but leaves the resistant ones and therefore selects a strain of the pest or disease that contains an increasing number of resistant individuals. Once this resistant proportion reaches a critical level, the lack of control ultimately renders that pesticide useless. This is known as resistance.

What pesticides are prone to resistance?

All pesticides (herbicides, insecticides, miticides and fungicides) are prone to resistance but miticides and some of the fungicides are most at risk. This is because mites and fungi are usually resident in orchards and have a short life cycle. These attributes favour the rapid selection of resistant individuals if pesticide use is heavy.

Resistance has occurred in almost every miticide since the 1950s. Fortunately new groups of miticides which possess different modes of activity have been released over the past decade. Details of the miticides registered for use in WA deciduous fruit tree orchards is updated regularly by the Department of Agriculture and Food. View the Department's website which includes guidelines for spray thresholds and the best way to use miticides to avoid the development of resistance.

Many of the new generation fungicides were developed for a specific disease and have a very specific mode of action. This means that they often have only single-site activity. Many of the older fungicides have multi-site activity and as a consequence the newer fungicides are more prone to the diseases developing resistance to them.

If the same fungicide is used repeatedly it will allow the resistant spores to multiply until almost all spores are resistant and unaffected by the fungicide. Often when a disease becomes resistant to a particular fungicide it is resistant to other fungicides in the same activity group. See information under Resistant Management Strategies for Fungicides, developed by **CropLife Australia**.

How do I avoid or delay resistance?

All new pesticide products have resistance management strategies included on the label. It is important that pesticides are applied using the correct dilutions and application rate and that the resistance management guidelines given on the label are followed.

Some of the key factors to avoid or delay resistance are based on the principles of Integrated Pest Management and include:

- **Predators** — There may be opportunity to introduce predators for pest control or suppression. This may reduce the pest to a level where a pesticide is not required or reduce the number of sprays required. Also be aware of any other pesticides that are harmful to predators, either natural or introduced. If available, select pesticides that are least harmful to natural enemies.

Information on the suitability of pesticides for preservation of natural enemies, based on their toxicity is given in the following manuals:

Integrated pest and disease management for Australian summer fruit by S Hetherington. (2005). NSW Department of Primary Industries and Summer Fruit Australia. Tel: +61 (0)2 6391 3800.

Integrated pest management for Australian apples and pears by S Hetherington. (2009). NSW Department of Primary Industries and Apple and Pear Australia Limited. Tel: +61 (0)2 6391 3800.

Information is also available on these websites:

goodbugs.org.au/chemicals.html
side-effects.koppert.nl

- **Cultural control methods** — Using such techniques as orchard hygiene e.g. destroying fallen fruit (Medfly, carpophilus beetle), can reduce the pest population and subsequently reduce exposure to pesticide.
- **Pest monitoring** — This will determine when a pest or disease is present and help decide whether a spray is required, and if required, the optimum time to apply it.
- **Pesticide use** — Many pesticides are listed to be used only a specific number of times in a season. Some miticides should only be used once per season. If multiple sprays are required then alternate between different activity groups. This applies to fungicides used for postharvest treatment which should not be from the same activity group as the one used for the last field treatment. The activity group (chemical class) of all the pesticides registered for use in orchards is in the spray options tables.

CropLife Australia represents the developers, registrants, manufacturers and formulators of plant science solutions for use in agriculture and the management of pests in other settings. This group has developed Pesticide Resistance Management Strategies and Activity Group Identification to assist in reducing the development of resistance to pesticides for a range of agricultural pests. Further information about CropLife Australia or their Resistance Management Strategies can be obtained from their office:

CropLife Australia Limited

Level 2, AMP Building, 1 Hobart Place Canberra ACT 2601

Locked Bag 916 Canberra ACT 2601

Tel: +61 (0)2 6230 6399

Fax: +61 (0)2 6230 6355

Email: info@croplifeaustralia.org.au

Website: croplifeaustralia.org.au

6. Quarantine issues

6.1 HortGuard

HortGuard is an initiative of the Department of Agriculture and Food, Western Australia to protect the \$650 million horticultural industry from major pests and to minimise risk of chemical residue in produce.

HortGuard encompasses but is not limited to quarantine, export certification, surveillance, pest and disease control, and relevant state, national and international events that could impact on the WA horticulture industry, research and innovation, product integrity, and market access and trade.

The Horticulture Industry Biosecurity Committee operating under HortGuard provides a forum for WA horticulture industries, associated parties and DAFWA to consult on matters that relate to biosecurity, chemical residues and market access related issues.

HortGuard links with existing industry and DAFWA activities such as:

- Australian Government Department of Agriculture, Biosecurity (formerly Australian Quarantine and Inspection Services) and Quarantine WA
- activities of Landcare groups and individual growers
- DAFWA's extensive threat identification, risk assessment, surveillance, control and eradication programs
- research programs on breeding disease resistance plants, insects which threaten the horticultural industry and integrated pest management systems
- on-farm and company-based quality assurance programs.

Contact for an orchard incident is:

Department of Agriculture and Food, Western Australia – Biosecurity emergency contacts

Exotic Plant Pest and Disease Hotline: Phone 1800 084 881

Email: info@agric.wa.gov.au.

For enquiries about HortGuard, contact:

HortGuard Co-coordinator: Bill Trend
Department of Agriculture and Food, Western Australia
Locked Bag 4
Bentley Delivery Centre WA 6983
Tel: +61 (0)8 9368 3535
Fax: +61 (0)8 9474 2479
Mob: +61 (0)427 995 808
Email: bill.trend@agric.wa.gov.au

6.2 Neglected orchards

DAFWA is involved with aiming to reduce the risk posed to commercial orchards by diseases and pests which may be harboured and spread as a result of no management of fruit trees and vines.

Orchardists can assist in this process by reporting obviously neglected orchards in WA to their industry sub committee, for example:

Pomewest

Executive Officer
3 Baron-Hay Court
South Perth WA 6151
Tel: +61 (0)8 9368 3869
Fax: +61 (0)8 9368 3128
Email: admin@fruitwest.org.au

Postal Address: PO Box 7198 Karawara WA 6152

Reports must be in writing and include the following information:

1. address/location of the orchard
2. proximity to nearest commercial orchard
3. name of owner of the orchard if possible
4. name and contact details of person or group reporting. This information remains confidential.

An inspector from DAFWA will visit the property within 14 days of receipt of a written report.

The result of the visit will be communicated within another 14 days.

7. Industry contact and technical information

7.1 Department of Agriculture and Food offices

South Perth (Head Office)	3 Baron-Hay Court South Perth WA 6151 Locked Bag 4, Bentley Delivery Centre WA 6983 Tel: +61 (0)8 9368 3333 Fax: +61 (0)8 9474 2405 Email: enquiries@agric.wa.gov.au
Albany	444 Albany Highway, Orana, Albany WA 6330 Tel: +61 (0)8 9892 8444 Fax: +61 (0)8 9841 2707 Email: albany@agric.wa.gov.au
Bunbury	Verschuer Place, South West Highway PO Box 1231 Bunbury WA 6231 Tel: +61 (0)8 9780 6100 Fax: +61 (0)8 9780 6136
Carnarvon	South River Road PO Box 522 Carnarvon WA 6701 Tel: +61 (0)8 9956 333 Fax: +61 (0)8 9941 8334
Esperance	Melijnup Road, PMB 50, Esperance WA 6450 Tel: +61 (0)8 9083 1111 Fax: +61 (0)8 9083 1100
Geraldton	20 Gregory Street PO Box 110 Geraldton WA 6530 Tel: +61 (0)8 9956 8555 Fax: +61 (0)8 9921 8016
Kununurra	Frank Wise Institute, Durack Drive PO Box 19 Kununurra WA 6743 Tel: +61 (0)8 9166 4000 Fax: +61 (0)8 9166 4066
Manjimup	Manjimup Horticultural Research Institute 28527 South Western Highway Locked Bag 7 Manjimup WA 6258 Tel: +61 (0)8 9777 0000 Fax: +61 (0)8 9777 0001 Email: manjimupdo@agric.wa.gov.au
Mount Barker	Research Facility 299 Eulup-Manurup Road RMB 615 Mount Barker WA 6324 Tel: +61 (0)8 9851 1427 Fax: +61 (0)8 9851 1665
Northam	75 York Road PO Box 483 Northam WA 6401 Tel: +61 (0)8 9690 2000 Fax: +61 (0)8 9622 1902
Waroona	120 South West Highway Waroona WA 6215 Tel: +61 (0)8 9733 7777 Fax: +61 (0)8 9733 2377

7.2 Fruit industry associations in WA

Pome, citrus and stone fruit producers' sub committees of the Agricultural Produce Commission in Western Australia.

Pomewest

Executive Officer PO Box 7198 Karawara WA 6152
Building 16, 3 Baron-Hay Court
South Perth WA 6151
Tel: +61 (0)8 9368 3869 Fax: +61 (0)8 9368 3128
Email: admin@fruitwest.org.au

Office bearers for other fruit subcommittees to be decided.

Industry associations:

Hills Orchard Improvement Group (HOIG)

Address PO Box 129 Kalamunda WA 6926

President Bruno DelSimone
Tel: +61 (0)8 9293 7132

Secretary David Fennell
Tel: +61 (0)8 9293 7152
Email: dfennell@mercermoney.com.au

Meetings As advised

Donnybrook Orchard Improvement Group (DOIG)

Address PO Box 29 Donnybrook, WA 6239

President Charles Williams
Tel: +61 (0)409 761 199
Email: astleypark@gmail.com

Treasurer-Secretary Ron Robertson +61 (0)8 9764 1272
Email: woodland2@iinet.net.au

Meetings Third Monday of every month.

Manjimup Orchard Group

Coordinator: Stephanie Carstairs
Tel: +61 (0)428 712 852

Meetings: As advised

7.3 Orchard reference material and further reading

Australian *Fruitgrower*, published monthly by Apple and Pear Australia Limited.

Managing Editor: Sophie Clayton
Email: cm@apal.org.au

Department of Agriculture and Food website: agric.wa.gov.au

Search the website for information on deciduous fruit under Crops, Fruit.

7.4 Orchard industry websites

Agricultural industry organisations

Apple and Pear Australia Limited – apal.org.au

Horticulture Australia Limited – horticulture.com.au

National Farmers Federation – nff.org.au

Summerfruit Australia Ltd – summerfruit.com.au

State government

Department of Agriculture and Food, Western Australia - agric.wa.gov.au

Department of Primary Industries, New South Wales – dpi.nsw.gov.au

Department of Primary Industries, Victoria – dpi.vic.gov.au

Department of Primary Industries & Resources, South Australia – pir.sa.gov.au

Queensland Government Agriculture, Fisheries & Forestry – daff.qld.gov.au

Tasmanian Department of Primary Industries, Parks, Water & Environment – dpipwe.tas.gov.au

Rural assistance

Centrelink – centrelink.gov.au

Rural Skills Australia – ruralskills.com.au

WorkSafe – safetyline.wa.gov.au

Federal government

ABC Rural Department – abc.net.au/rural

Austrade – austrade.gov.au

Australian Pesticides and Veterinary Medicines Authority – apvma.gov.au

Australian Quarantine and Inspection Service, Biosecurity in Australia – daff.gov.au/biosecurity

Department of Agriculture– daff.gov.au

Plant Health Australia – planthealthaustralia.com.au

Climate

Australian Bureau of Meteorology – bom.gov.au

Elders Weather – eldersweather.com.au

The Long Paddock – longpaddock.qld.gov.au

Environment

Department of Sustainability, Environment, Water, Population & Communities – environment.gov.au

Office of Environment & Heritage – environment.nsw.gov.au

USA Environmental Protection Agency – epa.gov

Biological and organic systems

Organic Federation of Australia – ofa.org.au

Economic & general information

Department of Agriculture, Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) – daff.gov.au

Rural Bookshop – ruralbookshop.com.au

Market price information

Perth Market Authority – perthmarket.com.au

Postharvest Fresh – postharvest.com.au

Technical production information

Agencies & universities

Commonwealth Scientific and Industrial Research Organisation (CSIRO) – csiro.au

CropLife Australia – croplifeaustralia.org.au

Agricultural and Natural Sciences, University of Adelaide – waite.adelaide.edu.au

Fruit and Nut Research and Information Centre, University of California –
fruitsandnuts.ucdavis.edu/datastore

New Zealand Ministry for Primary Industries – mpi.govt.nz

South Australian Research and Development Institute – sardi.sa.gov.au

United Kingdom Department for Environment, Food & Rural Affairs – gov.uk/defra

United States Department of Agriculture – usda.gov

Integrated pest management

Australasian Biological Control Association Inc. – goodbugs.org.au

Biological Services – biologicalservices.com.au

Bugs for bugs – bugsforbugs.com.au

Infopest Growcom – growcom.com.au

Noxious weeds – weeds.org.au

Quality assurance

Freshcare Australia – freshcare.com.au

Standards Australia – standards.com.au

Postharvest

Sydney Postharvest Laboratory – postharvest.com.au

Nurseries

ANFIC (Australian Nurserymen's Fruit Improvement Company) – anfic.com.au

Dave Wilson Nursery (California) – davewilson.com

Fleming's Nurseries (Victoria) – flemings.com.au

Olea Nurseries (Western Australia) – oleanurseries.com.au

8. Diagnostic service—AGWEST Plant Laboratories and Pest and Disease Information Service (PaDIS)

AGWEST Plant Laboratories provides a friendly and efficient service designed to assist growers improve their productivity and sustainability and to protect their resources.

Some of services available to orchardists include:

- plant disease diagnostics
- weed identification
- insect identification.

Sampling kits including submission forms are available from your nearest office of Department of Agriculture and Food.

Dispatch samples with completed submission form freight free from any WA Australia Post Office to:

AGWEST Plant Laboratories
Department of Agriculture and Food, Western Australia
Reply Paid 83377
South Perth WA 6151

or by the fastest available dispatch service.

Contact details:

AGWEST Plant Laboratories
Locked Bag 4 Bentley Delivery Centre WA 6983
3 Baron-Hay Court South Perth WA 6151
Tel: +61 (0)8 9368 3721
Fax: +61 (0)8 9474 2658
Email: agwestplantlabs@agric.wa.gov.au
Website: agric.wa.gov.au/plant-biosecurity/agwest-plant-laboratories

The Pest and Disease Information Service (PaDIS) provides advisory and identification services on animal and plant pests, weeds and diseases that impact Western Australia's agriculture and food industries. The service has a frontline role for the detection and reporting of unfamiliar and potentially damaging pest, weeds and diseases of agricultural and quarantine concern.

To contact PaDIS

Freecall: 1800 084 881
Email: info@agric.wa.gov.au
Mobile: +61 (0)427 994 546

9. Development stages of apple blossom

Photographs by Shane Hetherington, NSW Department of Primary Industries



Dormant



Green tip



Early spurburst



Pink bud



King bloom



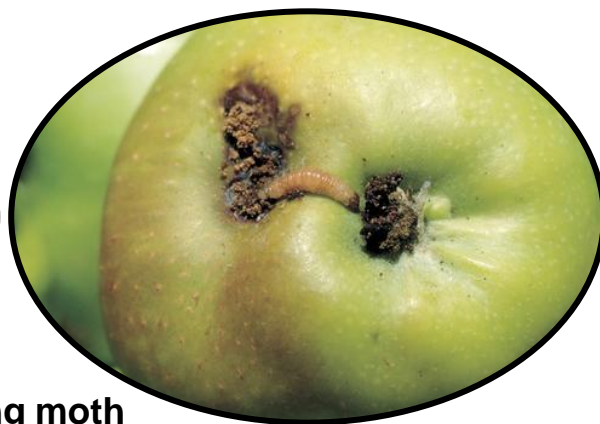
Full bloom



Complete petal fall

10. Pome fruit exotic pests

These are our 'targets'



Codling moth



Fireblight



Brown rot of apples

11. Apple

11.1 Apple pest and disease monitoring and treatment calendar

Not all these pests will occur in your orchard

NOTE: The pest status of each pest varies across fruit growing districts; monitor to avoid unnecessary or poorly timed spraying.

Pest / quality issue	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July
Dormancy release												
Snails												
Bryobia mite and European red mite												
San Jose scale and other scale												
Mealybug												
Woolly aphid												
Apple scab												
Powdery mildew												
Apple dimpling bug												
Plague thrips, Western flower thrips												
Wingless grasshopper												
Spring beetle												
Fungal surface infections, see below												
Garden weevil												
Lightbrown apple moth												
Apple looper												
Collar rot												
Heliothis caterpillar												
Apple weevil												
Fuller's rose weevil												
Two-spotted mite												
Mediterranean fruit fly												
Bitter pit												

■ Timing for monitoring and treatment if required.

Fungal surface infections include *Alternaria*, bitter rot, fly speck, sooty blotch and target spot

11.2 Apple spray options

Reference: Infopest online

For extra 'low risk' options for use of pesticides, refer to Section 3.7 page 10.

 Shaded boxes for 'Active ingredients' indicates they are acceptable for organic agriculture.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Dormant	Snails	copper sulphate	unspecified	Bluestone + wetting agent	N/A	Soil and butt spray only.
		copper	molluscicide	Escar-Go	1	Go to DAFWA website: 'Snail and slug control'.
		iron EDTA complex		Multiguard Snail and Slug Killer Eradicate	N/A	Apply after rain or irrigation. Do not place pellets in heaps.
		methiocarb	1A	Mesuroil Snail and Slug Bait	7	Apply to ground only, place bait close to tree trunk.
		metaldehyde	molluscicide	Various		
		silicate salts + copper	unspecified	Socusil Snail Repellent	N/A	
	Dormancy break	fatty acid esters	unspecified	Waiken	N/A	Apply 35-50 days before budbreak would normally occur. Useful as a pre-treatment to chemical thinning in apples as it will compact flowering.
Late dormancy to green tip	Apple scab (black spot)	lime sulphur	M2	Various	N/A	Do not apply after green tip.
	Bryobia mite	paraffinic / petroleum oil	insecticide, spray adjuvant	Various	1	Go to DAFWA website: 'Management of European red mite in WA' and 'Miticides for WA deciduous fruit trees'.
	European red mite					
	San Jose scale (continues next page)	paraffinic / petroleum oil	insecticide, spray adjuvant	Various	1	Rigorous agitation is required to maintain oil in suspension. Oil can be combined with one of the insecticides to improve control.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Late dormancy to green tip	San Jose scale (cont.)	chlorpyrifos	1B	Various	14	Do not apply oil or insecticide if any part of the tree is more advanced than tight cluster as the insecticide is toxic to bees and in combination with oil is phytotoxic to flowers.
		diazinon		Diazinon Diazinon 800 Diazol 800		
		lime sulphur	M2	Lime Sulphur	N/A	Do not use on Delicious or Cox's Orange Pippin.
		methidathion	1B	Suprathion 400 EC	14	
Green tip	Apple scab (black spot)	copper ammonium acetate	M1	Cop-IT Liquicop Copper - Count-N	1	Go to DAFWA website: 'Managing apple scab in WA'.
		copper ammonium complex		Copperguard		
		copper oxychloride cupric hydroxide		Various		
		cupric hydroxide + mancozeb	M1 + M3	ManKocide DF	14	
		cuprous oxide	M1	Nordox 500 Nordox 750 WG Ag Copp 750 Red Copper WG	1	
		tri-basic copper sulphate		Tri-Base Blue Tribasic Liquid Bordeaux WG		
		Powdery mildew	lime sulphur	M2	Various	
	sulfur		Various			
	Bitter rot	copper oxychloride	M1	Various	1	Oil can be combined with copper to improve control.
		zineb	M3	Zineb	14	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Green tip	Woolly aphid	imidacloprid	4A	Various	N/A	Apply around the base of trees. Use on trees up to 7 years old. Do not treat more than once in any 2-year period. Use low rate if aphid wasp parasite is present.
		clothianidin		Samurai	21	Soil drench. Read label thoroughly before use.
	Target spot, sooty blotch and flyspeck	mancozeb and copper hydroxide	M1 + M3	ManKocide DF	14	Do not spray after green tip, as the copper may be phytotoxic.
Tight cluster to early pink bud	Apple dimpling bug	chlorpyrifos	1B	Strike-Out 500 WP Cyren 500 WP Lorsban50 WG	14	Chlorpyrifos and sulfoxaflor are extremely toxic to bees; apply before flowering. If cover crop is flowering mow before application. Go to DAFWA website: 'Managing apple dimpling bug'.
		sulfoxaflor	4C	Transform	7	
	Apple scab (black spot) (continues next page)	boscalid + pyraclostrobin	7 + 11	Nufarm Pristine	14	Go to DAFWA website: 'Managing apple scab in WA'.
				BASF Pristine	28	
		captan	M4	Various	7	
		cyprodinil	9	Chorus	N/A	
		dithianon	M9	Delan 700 WG Dithianon 700 WG Dragon 700 WG	21	
		mancozeb	M3	Various	14	
		metiram		Polyram DF	21	
		sulfur	M2	Various	Nil	
		thiram	M3	Thiragranz Thiram WP Thiram DG	7	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Tight cluster to early pink bud	Apple scab (black spot) (cont.)	trifloxystrobin	11	Flint 500 WG	35	
		ziram	M3	Ziram Granuflo Ziragranz Ziram DG	7	
Pink bud to end of blossom	Apple dimpling bug and plague thrips	bifenthrin	3A	Various	14	Go to DAFWA website: 'Managing apple dimpling bug'.
		methomyl	1A	Various	1	
		tau-fluvalinate	3A	Mavrik Aquaflo Klartan	N/A	Apply early blossom, from pink bud to 20% bloom. Do not apply outside bloom period. Apply a maximum of 2 non-consecutive sprays per season. May affect beneficials of pest mites.
	Apple dimpling bug	thiacloprid	4A	Calypso 480 SC	21	
	Western flower thrips	spinetoram	5	Delegate	3	Refer to label for important WFT resistance strategy. Go to DAFWA website: 'Thrips pests in pome and stone fruit'.
	Powdery mildew (continues next page)	bupirimate	8	Nimrod Nimrod 250 EC	7	Apply on a 14 day schedule over flowering and early fruit development.
		boscalid + pyraclostrobin	7 + 11	Nufarm Pristine	14	
				BASF Pristine	28	
		fenarimol	3	Rubigan SC	14	Do not use on McIntosh apples or related varieties. May reduce fruit length under certain conditions.
		hexaconazole		Hostile 50 SC Synan Viva Hex 50 SC	7	
		kresoxim-methyl	11	Stroby WG Disco WG Kresta WG	42	Apply at 7–10 day intervals during rapid growth. Later applications can be at 10–14 days.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Pink bud to end of blossom	Powdery mildew (cont.)	myclobutanil	3	Butanil 400 WP Domiclo 400 WP Systhane 400 WP	21	
		penconazole		Topas 100 EC Delos	14	
		penthiopyrad	7	Fontelis	28	
		pyrimethanil + fluquinconazole	3 + 9	Vision 250 SC	N/A	Do not spray 4 weeks after petal fall. Do not apply more than 3 sprays per season.
		sulfur	M2	Various		Apply at 2–3 weekly intervals from pink bud to petal fall. Do not apply to sulphur-sensitive varieties in hot weather.
		trifloxystrobin	11	Flint 500 WG	35 (70 for Export)	Apply as a block of three treatments with 10 day intervals. Do not apply more than 3 sprays per season.
		triforine	3	Saprol	1	Do not apply to Golden Delicious or Cox's Orange Pippin. Apply at 10–14 day intervals.
Petal fall to early fruit development	Apple scab (black spot) (continues next page)	Curative sprays (post-infection)				Go to DAFWA website: 'Managing apple scab in WA'. If weather conditions favour secondary infections, sprays may be required up to harvest.
		difenoconazole	3	Bogard 100 WG	28	
		dodine	M7	Syllit 400 SC	5	
		fenarimol	3	Rubigan SC	14	
		hexaconazole		Hex 50 SC Hostile 50 SC Synan Viva	7	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Petal fall to early fruit development	Apple scab (black spot) (cont.)	myclobutanil	3	Butanil 400 WP Domiclo 400 WP Systhane 400 WP	21	
		penconazole		Delos Topas 100 EC	14	
		pyrimethanil + fluquinconazole	3 + 9	Vision 250 SC	N/A	
		triforine	3	Saprol	1	
		Protectant sprays (pre-infection)				
		boscalid + pyraclostrobin	7 + 11	Nufarm Pristine	14	
				BASF Pristine	28	
		captan	M4	Various	7	
		cyprodinil	9	Chorus	N/A	
		dithianon	M9	Delan 700 WG Dithianon 700 WG Dragon 700 WG	21	
		kresoxim-methyl	11	Stroby WG Disco WG Kresta WG	42	
		mancozeb	M3	Various	14	
		metiram		Polyram DF	21	
		penthiopyrad	7	Fontelis	28	
		sulphur	M2	Various	Nil	
		thiram	M3	Thiram WP Thiram DG	7	
		trifloxystrobin	11	Flint 500 WG	35	WHP = 70 for export.
		ziram	M3	Ziram Granuflo Ziragranz Ziram DF	7	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Petal fall to early fruit development	Mealybugs	chlorpyrifos	1B	Various	14	Apply at petal fall and 10–14 days later.
		methidathion		Suprathion 400 EC		Mealybugs excrete honeydew which encourages sooty mould to grow on the fruit.
	Longtailed mealybug	clothianidin	4A	Samurai	21	Apply as crawlers emerge after petal fall – 2 sprays 14 days apart.
		sulfoxaflor	4C	Transform	7	
	Longtailed mealybug and tuber mealybug	spirotetramat	23	Movento	21	Do not apply prior to petal fall. Apply with surfactant – refer to label for details.
	Heliothis caterpillar (native budworm)	<i>Bacillus thuringiensis</i>	11C	Various	Nil	
		carbaryl	1A	Bugmaster Flowable Carbaryl 500 SC	77	Do not apply to apples within 30 days AFTER full bloom if reduction in fruit set is not desired.
		chlorantraniliprole	28	Altacor	14	
		<i>Helicoverpa</i> NPV	insecticide - virus	Vivus Gold Vivus Max Gemstar LC	N/A	Thorough coverage is essential as product must be ingested. Most effective against young larvae.
		indoxacarb	22A	Avatar	14	
		methomyl	1A	Various	1	
		pyrethrins + piperonyl butoxide	3A	Py-Bo		
		spinetoram	5A	Delegate	3	
	Spring beetle	azinphos-methyl	1B	Gusathion 200 SC Benthion 200 Flowable	14	Avatar may help control spring beetle.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Early fruit development	Garden weevil and Apple weevil (curculio beetle)	alpha cypermethrin	3A	Various	14	Trunk and butt spray only. Monitor weevil emergence using a single- sided cardboard trunk band. Continue monitoring after spraying. Summer oil can be added at 1–2% to help prolong residual activity.
		indoxacarb	22A	Avatar		Foliar application.
	Wingless grasshopper	chlorpyrifos	1B	Various	14	Go to DAFWA website: 'Wingless grasshoppers and their control'. Baiting can also be used.
		carbaryl	1A	Bugmaster Flowable Carbaryl 500 SC	77	Do not apply to apples within 30 days AFTER full bloom if reduction in fruit set is not desired.
				Cricket and Grasshopper Killer Bait	N/A	
		indoxacarb	22A	Avatar	14	
		maldison	1B	Fyfanon ULV	3	
		<i>Metarhizium anisopliae</i>	biological insecticide	Green Guard SC	N/A	For best results, apply when grasshoppers are at early nymph stage. Refer to label for details of application.
	San Jose scale (crawlers) (continues next page)	azinphos-methyl	1B	Gusathion 200 SC Benthion 200 Flowable	14	With azinphos-methyl add 1.2 L/100 L of summer oil.
		chlorpyrifos		Various		This pest is most susceptible to chemical control methods when crawlers are active, in mid to late November.
		diazinon		Diazinon Diazinon 800 Diazol 800		With diazinon add 1.2 L/100 L of summer oil.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Early fruit development	San Jose scale (crawlers) (cont.)	fenoxycarb	7B	Insegar WG	14	Suppresses scale when used in a full season schedule against lightbrown apple moth.
		methidathion	1B	Suprathion 400EC		
		spirotetramat	23	Movento	21	Do not apply prior to petal fall. Apply with surfactant – refer to label for details.
Fruit development to harvest	Bitter pit (storage disorder)	calcium nitrate		Various	N/A	Use calcium nitrate on green apples.
		calcium chloride		Various		Use calcium chloride on red apples. Apply 3–4 applications 3 to 4 weeks apart. Can be mixed with fungicides or insecticides.
	Two-spotted mite (continues next page) Ovicides (O) kill mite eggs and newly hatched mites. Adulticides (A) kill active stages of mites.	abamectin (A) + summer oil	6	Various	14	Apply 2-6 weeks after petal fall or soon after mite numbers have reached the threshold level for your area.
		bifenazate (A)	UN	Acramite	7	
		chlorfenapyr (A)	13	Secure 360 SC	14	Apply only once per season.
		clofentezine (O)	10A	Apollo SC	21	
		etoxazole (O)	10B	Paramite		Go to DAFWA website: 'Miticides for WA deciduous fruit trees'.
		fenbutatin oxide (A)	12B	Torque Vendex	2	
		hexythiozox (O)	10A	Calibre 100 EC Hexythiazox 100 EC	3	
		maldison (A)	1B	Fyfanon 440 EW Maldison 500 Malathion 500 EC		
		methidathion (A)		Suprathion 400 EC	14	
		milbemectin (OA)	6B	Milbeknock	7	
		oxythioquinox (A)	14	Morestan	N/A	Postharvest only.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Fruit development to harvest	Two-spotted mite (cont.)	paraffinic oil (A)	insecticide spray adjuvant	Biopest Bioclear Trump Spray Oil	1	
		petroleum oil (A)		Biocover		
		fatty acids – K salt	insecticide	Bug Guard Hitman Natrasoap	N/A	
		propargite (A)		Omite 300 W Betamite 300 WG Unimite 300 W Omite	7	
		tebufenpyrad (O,A)	21A	Pyranica	14	
	European red mite (continues next page) Ovicides (O) kill mite eggs and newly hatched mites. Adulticides (A) kill active stages of mites.	abamectin (A) + summer oil	6	Various	14	Apply 2-6 weeks after petal fall or soon after mite numbers have reached the threshold level for your area.
		bifenazate (A)	UN	Acramite	7	
		clofentezine (O)	10A	Apollo SC	21	Go to DAFWA website: 'Management of European red mite in WA'.
		etoxazole (O)	10B	Paramite		
		fenbutatin oxide (A)	12B	Torque Vendex	2	
		hexythiozox (O)	10A	Calibre 100EC Hexythiazox 100 EC	3	
		maldison (A)	1B	Fyfanon 440 EW Maldison 500 Malathion 500 EC		
		milbemectin (O,A)	6B	Milbeknock	7	
		oxythioquinox (A)	14	Morestan	N/A	Postharvest only.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments	
Fruit development to harvest	European red mite (cont.)	paraffinic oil (A)	insecticide spray adjuvant	Biopest Bioclear Trump Spray Oil	1		
		petroleum oil (A)		Biocover			
		propargite (A)	12C	Omite 300W Betamite 300 WG Unimite 300 W Omite	7		
		tebufenpyrad (O,A)	21A	Pyranica	14		
	Bryobia mite	azinphos-methyl	1B	Benthion 200 Flowable Gusathion 200 SC	14	Go to DAFWA website ‘Miticides for WA deciduous fruit trees’.	
		bifenazate	UN	Acramite	7		
		clofentezine	10A	Apollo SC	21		
		fenbutatin oxide	12B	Torque Vendex	2		
		paraffinic oil (A)	insecticide spray adjuvant	Biopest Bioclear Trump Spray Oil	1		
		petroleum oil (A)		Biocover			
	Lightbrown apple moth (and apple looper) (continues next page)	azinphos-methyl	1B	Benthion 200 Flowable Gusathion 200 SC	14		
		<i>Bacillus thuringiensis</i>	11C	Various	Nil		
		carbaryl	1A	Bugmaster Flowable Carbaryl 500 Flowable Carbaryl 500 SC	77		
		chlorantraniliprole	28	Altacor	14		
		chlorpyrifos	1B	Various			
		fenoxycarb	7B	Insegar WG			
		indoxacarb	22A	Avatar			

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Fruit development to harvest	Lightbrown apple moth (and apple looper) (cont.)	methidathion	1B	Suprathion 400 EC	14	Best results achieved using a schedule of 3 sprays at 14 day intervals.
		methomyl	1A	Various	1	
		methoxyfenozide	18	Prodigy	14	
		pyrethrins + piperonyl butoxide	3A	Py-Bo	1	Target sprays against mature eggs and newly-hatched larvae.
		spinetoram	5	Delegate	7	
	Fuller's rose weevil and Apple weevil (curculio beetle)	azinphos-methyl	1B	Benthion 200 Flowable Gusathion 200 SC	14	Apply lower rate as a high volume spray to foliage. Use higher rate as a butt and soil spray only.
		indoxacarb	22A	Avatar		Foliar spray. Do not apply more than 2 sprays per season.
	Mealybugs	chlorpyrifos	1B	Various	14	Apply 2–3 weeks before harvest if pest numbers are high.
		fatty acids K salt	insecticide	Hitman Bug Guard Natrasoap	N/A	
		methidathion		Suprathion 400 EC Ridacide 400 EC	14	Mealybugs excrete honeydew which encourages sooty mould to grow on the fruit.
	Longtailed mealybug	clothianidin	4A	Samurai	21	
		sulfoxaflor	4C	Transform	7	
	Longtailed mealybug and tuber mealybug	spirotetramat	23	Movento	21	Do not apply prior to petal fall. Apply with surfactant – refer to label for details.
	Woolly aphid (continues next page)	azinphos-methyl	1B	Benthion 200 Flowable Gusathion 200 SC	14	
		chlorpyrifos		Various		

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments	
Fruit development to harvest	Woolly aphid (cont.)	clothianidin	4A	Samurai	21	Read label before using.	
		diazinon	1B	Diazinon 800 Diazol 800 Diazinon	14	Add 1.2 L/100 L of summer oil.	
		maldison		Various	3		
		methidathion		Suprathion 400EC	14		
		pirimicarb		1A	Various		2
		spirotetramat	23	Movento	21	Suppression only. Do not apply prior to petal fall. Apply with surfactant – refer to label for details.	
		sulfoxaflor	4C	Transform	7		
		Collar rot (<i>Phytophthora</i>)	fosetyl	33	Aliette WG Crop Culture Nobility WG Fostal 80 WP	14	Can be applied as a foliar spray or as a soil drench.
	Mediterranean fruit fly (continues next page)	Foliar baiting:					.
		maldison	1B	Fyfanon 1000 EC Hy-Mal Maldison 500 Maldison 500 EC	3	Go to DAFWA website for latest information	
		spinosad	5	Naturalure Eco-Naturalure	N/A		
		trichlorfon	1B	Dipterex 500 SL Lepidex 500	2		
		Protein to add to baits:					
		yeast autolysate		Fruit Fly Lure Natflav 500	N/A	Add 2 L of protein for every 100 L water + insecticide. Add protein first, then insecticide + water.	
		yeast hydrolysate		Flavex			

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments	
Fruit development to harvest	Mediterranean fruit fly (cont.)	Cover spray:					
		clothianidin	4A	Samurai	7	PER14252, expires 30 June 2015. Use with MAXX surfactant.	
		fenthion	1B	Lebaycid	10	PER13840 expires 29 October 2015. Check revised labels following the APVMA review of fenthion.	
		spinetoram	5	Delegate		PER12590, expires 31 May 2016.	
		trichlorfon	1B	Dipterex 500 SL Lepidex 500	2		
		thiacloprid	4A	Calypso	21	PER14562, expires 30 November 2018.	
	Bitter rot	dithianon	M9	Delan 700 WG Dragon 700 WG	21		
		mancozeb	M3	Various	14		
		zineb		Zineb			
		ziram		Ziram DG	7		
	Target spot and ripe spot	mancozeb	M3	Various	14		
		thiram		Thiram DG Thiragranz	7		
	Sooty blotch	mancozeb		M3	Various	14	
		zineb	Zineb				
	Fly speck	mancozeb	Various				
	Alternaria fruit and leaf spot	boscalid + pyraclostrobin	7 + 11	Nufarm Pristine	14	PER12864, expires 30 June 2016.	
				BASF Pristine	28		
		dithianon	M9	Dragon 700 WG	21		
		metiram	M3	Polyram DF			

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Postharvest	Snails	copper sulphate	unspecified	Bluestone + wetting agent	N/A	Soil and butt spray only.
		iron EDTA complex	molluscicide	Multiguard Snail and Slug Killer Eradicate		Apply after rain or irrigation. Do not place pellets in heaps.
		metaldehyde		Various	7	Apply to ground only, place bait close to tree trunk.
		methiocarb	1A	Mesurool Snail and Slug Bait		
	San Jose scale	diazinon	1B	Diazinon Diazinon 800 Diazol 800	N/A	Apply in autumn if scale is evident in harvested crop. Add 1.2 L/100 L of summer oil.
	Woolly aphid	diazinon		Diazinon Diazinon 800 Diazol 800		Apply in autumn if aphid is evident in harvested crop. Add 1.2 L/100 L of summer oil.
	Apple scab (black spot)	Urea	-	Urea	N/A	Breaking down leaf litter with 5% urea helps prevent <i>pseudothecia</i> (fruiting bodies) developing.


12. Pear and nashi

12.1 Pear and nashi pest and disease monitoring and treatment calendar

Not all these pests will occur in your orchard

NOTE: The pest status of each pest varies across fruit growing districts; monitor to avoid unnecessary or poorly timed spraying.

Pest/ Disease	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July
Snails												
San Jose scale and other scale												
Mealybug												
Bryobia mite												
Pearleaf blister mite												
Pear scab												
Dimpling bug and thrips												
Spring beetle												
Garden weevil												
Lightbrown apple moth												
Two-spotted mite												
Pear slug												
Heliothis caterpillar												
Apple weevil												
Fuller's rose weevil												
Mediterranean fruit fly												

 Timing for monitoring and treatment if required.

12.2 Pear and nashi spray options

Reference: Infopest online.

For extra 'low risk' options for use of pesticides, refer to Section 3.7, page 10.

 Shaded boxes for 'Active ingredients' indicates they are acceptable for organic agriculture.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Dormant	Snails	copper sulphate	unspecified	Bluestone	N/A	Soil and butt spray only.
		copper	molluscicide	Escar-Go	1	Go to DAFWA website: 'Snail and slug control'.
		iron-EDTA complex		Multiguard Snail and Slug Killer Eradicate		
		metaldehyde		Various	7	Apply to ground only, place bait close to tree trunk.
		methiocarb	1A	Mesuroil Snail and Slug Bait		
		silicate salts + copper	unspecified	Socusil Snail Repellant	N/A	
Late dormancy to green tip	San Jose scale (continues next page)	paraffinic / petroleum oil	insecticide, spray adjuvant	Various	1	Rigorous agitation is required to maintain oil in suspension. Oil can be combined with a listed insecticide to improve control. Do not apply oil or insecticide if any part of the tree is more advanced than tight cluster because insecticide is toxic to bees and in combination with oil is phytotoxic to flowers. For dormant spray 2-3% winter oil may be added.
		chlорpyrifos	1B	Various	14	
		diazinon		Diazinon Diazinon 800 Diazol 800		
		methidathion		Ridacide 400 EC Suprathion 400EC		Add 3 L winter oil /100 L spray mix.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Late dormancy to green tip	San Jose scale (cont.)	polysulphide sulphur	M2	Lime Sulphur	N/A	Apply during dormancy up to bud swell.
	Bryobia mite	polysulphide sulphur	M2	Lime Sulphur		Apply during dormancy up to bud swell.
		paraffinic / petroleum oil	insecticide spray adjuvant	Various		Dormant spray only.
	Pearleaf blister mite	polysulphide sulphur	M2	Lime Sulphur		Apply during dormancy up to bud swell.
	Pear scab (black spot, pears only)	polysulphide sulphur	M2	Lime Sulphur		
Green tip	Longtailed mealybug	buprofezin	16	Various	56	Apply twice 10-14 days apart between swollen bud and end of flowering.
	Mealybug	prothiofos	1B	Tokuthion	56	Apply by dilute spraying equipment. Mix with semi-dormant oil. Apply when crawlers become active under bark. Spray to run-off. Follow-up sprays of other suitable insecticides may be required later if crawlers again become active.
	Pear scab (black spot, pears only) (continues next page)	boscalid + pyraclostrobin	7 + 11	Nufarm Pristine	14	Good pear scab control is reliant on a close spraying schedule from budburst to mid-December. Check labels for timing.
				BASF Pristine	28	
		cyprodinil	9	Chorus	N/A	
		copper ammonium complex	M1	Copperguard	1	
		copper hydroxide	M1	Various		
		copper oxychloride				

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Green tip	Pear scab (black spot, pears only) (cont.)	cuprous oxide	M1	Ag Copp 750 Red Copper WG Nordox 500 Nordox 750 WG	1	Oil can be combined with copper to improve control.
		tri-basic copper sulphate		Tri-Base Blue Cuprofix Disperss Bordeaux WG Tribasic Liquid		
		difenoconazole	3	Bogard 100 WG	28	Do not apply more than 4 sprays alone per season.
		fenarimol		Rubigan SC	14	
		hexaconazole		Hostile 50 SC Viva Hex 50 SC Synan		
		kresoxim-methyl	11	Stroby WG Disco WG Kresta WG	42	Do not apply more than 3 sprays from Group 11 per season.
		mancozeb	M3	Various	14	May be harmful to predatory mites.
		metiram		Polyram DF		
		myclobutanil	3	Systhane 400 WP Domiclo 400 WP Butanil 400 WP	21	After petal fall, add a protective fungicide.
		penconazole	3	Topas 100 EC Delos	14	Refer to label for tank mixing with other fungicides.
		penthiopyrad	7	Fontelis	28	
		pyrimethanil + fluquinconazole	3 + 9	Vision 250 SC	N/A	Do not apply Vision later than 4 weeks after petal fall. For export fruit DO NOT apply after petal fall.
		thiram	M3	Thiragranz Thiram DG Thiram WP	7	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Green tip	Pear scab (black spot, pears only) (cont.)	ziram	M3	Ziragranz Ziram DG Ziram Granuflo	7	
White bud to end of blossom (petal fall)	Longtailed mealybug	buprofezin	16	Various	56	Apply twice 10-14 days apart between swollen bud and end of flowering.
	Pear scab (black spot, pears only) (continues next page)	boscalid + pyraclostrobin	7 + 11	Nufarm Pristine	14	
				BASF Pristine	28	
		captan	M4	Various	7	Apply at 7 day intervals till petal fall, then 10-14 day intervals. Risk of russet in some varieties. No more than 5 sprays/season.
		cyprodinil	9	Chorus	N/A	Do not use after petal fall.
		difenoconazole	3	Bogard 100 WG	28	After petal fall apply only with a protectant scab fungicide.
		dodine	7	Syllit 400 SC	5	Read label carefully.
		fenarimol	3	Rubigan SC	14	Do not apply more than 4 sprays alone per season.
		hexaconazole		Hostile 50 SC Viva Hex 50 SC Synan		
		kresoxim- methyl	11	Stroby WG Disco WG Kresta WG	42	Do not apply more than 3 sprays from Group 11 per season.
		mancozeb	M3	Various	14	May be harmful to predatory mites.
		metiram		Polyram DF		
		myclobutanil	3	Domiclo 400 WP Systhane 400WP Butanil 400 WP	21	After petal fall, add a protectant fungicide.
		penconazole		Topas 100 EC Delos	14	Refer to label for tank mixing with other fungicides.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
White bud to end of blossom (petal fall)	Pear scab (black spot, pears only) (cont.)	pyrimethanil + fluquinconazole	3 + 9	Vision 250SC	N/A	Do not apply Vision later than 4 weeks after petal fall. For export fruit DO NOT apply after petal fall.
		thiram	M3	Thiragranz Thiram DG Thiram WP	7	
		ziram		Ziragranz Ziram DG Ziram Granuflo		
Petal fall to early fruit development	Pear scab (black spot, pears only) (continues next page)	boscalid + pyraclostrobin	7 + 11	Nufarm Pristine	14	
				BASF Pristine	28	
		captan	M4	Various	7	
		difenoconazole	3	Bogard 100 WG	28	After petal fall apply only with a protectant scab fungicide.
		dithianon	M9	Delan 700 WG Dithianon 700 WG Dragon 700 WG	21	
		dodine	7	Syllit 400 SC	5	Read label carefully.
		fenarimol	3	Rubigan SC	14	Do not apply more than 4 sprays alone per season.
		hexaconazole		Hostile 50 SC Viva Hex 50 SC Synan		
		kresoxim-methyl	11	Stroby WG Disco WG Kresta WG	42	Do not apply more than 3 sprays from Group 11 per season.
		mancozeb	M3	Various	14	May be harmful to predatory mites.
		metiram		Polyram DF		
			myclobutanil	3	Domiclo 400 WP Sythane 400WP Butanil 400 WP	21

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Petal fall to early fruit development	Pear scab (black spot, pears only) (cont.)	penconazole	3	Topas 100 EC Delos	14	Refer to label for tank mixing with other fungicides.
		pyrimethanil + fluquinconazole	3 + 9	Vision 250SC	N/A	Do not apply Vision later than 4 weeks after petal fall. For export fruit DO NOT apply after petal fall.
		thiram	M3	Thiragranz Thiram DG Thiram WP	7	
		trifloxystrobin	11	Flint 500 WG	35	Apply as a block of three treatments with 10 day intervals.
		zineb	M3	Zineb	14	
		ziram		Ziragranz Ziram DG Ziram Granuflo	7	
	Lightbrown apple moth (continues next page)	azinphos- methyl	1B	Benthion 200 Flowable Gusathion 200 SC	14	
		<i>Bacillus thuringiensis</i>	11C	Various	Nil	Adjust water volume and/or rate of product to ensure the minimum application rate /ha. Check label for minimum rate.
		chlorantraniliprole	28	Altacor	14	
		chlorpyrifos	1B	Various		Apply after petal fall, then 10–14 days later. May need follow-up sprays.
		fenoxycarb	7B	Insegar WG		Apply 7–10 days after petal fall. Thorough coverage essential. Will suppress San Jose scale in a full season program.
		indoxacarb	22A	Avatar		No more than 6 applications per season.
		methidathion	1B	Suprathion 400EC		

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Petal fall to early fruit development	Lightbrown apple moth (cont.)	spinetoram	5	Delegate	7	
	Mealybugs	chlorpyrifos	1B	Various	14	Apply first at petal fall then 10–14 days later. May need follow-up sprays.
		methidathion		Suprathion 400EC Ridacide 400 EC		Apply first at petal fall then 21 day intervals as required.
	Longtailed mealybug	clothianidin	4A	Samurai	21	Apply against crawlers after petal fall. Apply 2 sprays 14 days apart. Apply only as dilute spray for good coverage.
		sulfoxaflor	4C	Transform	7	
	Garden weevil	alpha-cypermethrin	3A	Various	14	Trunk and butt spray only. Monitor weevil emergence using a single-sided cardboard trunk band. Continue monitoring after spraying. Summer oil can be added at 1–2% to help prolong residual activity.
		indoxacarb	22A	Avatar		For weevils apply no more than twice per season. Do not retreat within 10 days. Do not apply for more than 2 consecutive seasons.
	Spring beetle	azinphos- methyl	1B	Gusathion 200 SC Benthion 200 Flowable	14	Avatar may help control spring beetle.
Fruit development to harvest	Heliothis caterpillar (native budworm) (continues next page)	<i>Bacillus thuringiensis</i>	11C	Various	Nil	Read 'Critical Comments' on label.
		carbaryl	1A	Bugmaster Flowable Carbaryl 500 SC	77	Do not apply within 30 days after full bloom if reduction in fruit set is not desired.
		chlorantraniliprole	28	Altacor	14	
		indoxacarb	22A	Avatar		No more than 6 applications per season.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Fruit development to harvest	Heliothis caterpillar (native budworm) (cont.)	<i>Helicoverpa</i> NPV	Insecticide - virus	Vivus Gold Vivus Max Gemstar LC	N/A	Thorough coverage is essential as product must be ingested. Most effective against young larvae.
		pyrethrins + piperonyl butoxide	3A	Py-Bo	1	
		spinetoram	5	Delegate	7	
	Lightbrown apple moth (continues next page)	azinphos-methyl	1B	Gusathion 200 SC Benthion 200 Flowable	14	
		<i>Bacillus thuringiensis</i>	11C	Various	Nil	Adjust water volume and/or rate of product to ensure the minimum application rate. Check label for minimum rate.
		carbaryl	1A	Bugmaster Flowable Carbaryl 500 Flowable Carbaryl 500 SC	77	Do not apply within 30 days after full bloom if reduction in fruit set is not desired.
		chlorantraniliprole	28	Altacor	14	
		chlorpyrifos	1B	Various		Apply after petal fall then 10–14 days later. May need follow-up sprays.
		fenoxycarb	7B	Insegar WG		Apply 7-10 days after petal fall. Thorough coverage essential. Will suppress San Jose scale in a full season program.
		indoxacarb	22A	Avatar		No more than 6 applications per season.
		methidathion	1B	Suprathion 400EC	2	
		methomyl	1A	Various		Apply at calyx stage from late November on.
		pyrethrins + piperonyl butoxide	3A	Py-Bo	1	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Fruit development to harvest	Lightbrown apple moth (cont.)	spinetoram	5	Delegate	7	Target sprays against mature eggs and newly-hatched larvae.
	Wingless grasshopper	carbaryl	1A	Cricket and Grasshopper Killer Bait	N/A	Go to DAFWA website: 'Wingless grasshoppers and their control'.
				Bugmaster Flowable Carbaryl 500 SC	77	
		chlorpyrifos	1B	Various	14	
		indoxacarb	22A	Avatar		Do not retreat within 10 days.
		maldison	1B	Fyfanon ULV	3	
		<i>Metarhizium anisopliae</i>	biological insecticide	Green Guard SC	N/A	For best results, apply when grasshoppers are at early nymph stage. Refer to label for details of application.
	Pear slug	azinphos-methyl	1B	Gusathion 200 SC Benthion 200 Flowable	14	
		carbaryl	1A	Bugmaster Flowable Carbaryl 500 SC	77	
		spinetoram	5	Delegate	7	
	Mealybug	chlorpyrifos	1B	Various	14	
		methidathion		Suprathion 400 EC		
	Longtailed mealybug and tuber mealybug	spirotetramat	23	Movento	21	Do not apply prior to fruitlets reaching 10 mm in diameter. Apply with surfactant – refer to label for details.
	San Jose scale (crawlers) (continues next page)	azinphos-methyl	1B	Gusathion 200 SC Benthion 200 Flowable	14	Apply late November to early March. For azinphos-methyl or diazinon add 1.2 L/100 L summer oil for dilute or concentrate spraying.
		chlorpyrifos		Various		Monitor scale for crawlers in early summer, for effective timing of sprays.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Fruit development to harvest	San Jose scale (crawlers) (cont.)	diazinon	1B	Diazinon 800 Diazinon Diazol 800	14	
		fenoxycarb	7B	Insegar WG		Suppresses scale when used in a full season schedule against lightbrown apple moth.
		methidathion	1B	Suprathion 400EC		
		spirotetramat	23	Movento	21	Do not apply prior to petal fall. Apply with surfactant – refer to label for details.
	Two-spotted mite (continues next page) Ovicides (O) kill mite eggs and newly hatched mites. Adulticides (A) kill active stages of mites.	abamectin (A)	6	Various	14	Apply with summer oil.
		bifenazate (A)	UN insecticide	Acramite	7	Use water volume not less than 1000 L/ha.
		chlorfenapyr (A)	13	Secure 360 SC	14	Apply only once per season.
		clofentezine (O)	10A	Apollo SC	21	
		etoxazole (A)	10B	Paramite		Go to DAFWA website: 'Miticides for WA deciduous fruit trees'.
		fenbutatin oxide (A)	12B	Torque Vendex	2	
		hexythiazox (O)	10A	Calibre 100EC Hexythiazox 100 EC	3	
		maldison (A)	1B	Fyfanon 440EW Malathion 500 EC Maldison 500		
		methidathion (A)	1B	Suprathion 400 EC	14	
		milbemectin (OA)	6B	Milbeknock	7	
		paraffinic oil (A)	insecticide, spray adjuvant	Bioclear Biopest Trump Spray Oil	1	
		petroleum oil (A)		Biocover		

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Fruit development to harvest	Two-spotted mite (cont.)	propargite (A)	12C	Omite 300 W	N/A	Postharvest only. May cause leaf spotting and defoliation in hot conditions.
		tebufenpyrad (OA)	21A	Pyranica	14	
	Pearleaf blister mite	carbaryl	1A	Bugmaster Flowable Carbaryl 500 Flowable Carbaryl 500 SC	77	
		paraffinic oil (A)	insecticide, spray adjuvant	Biopest Bioclear Trump Spray Oil	1	
		petroleum oil (A)		Biocover		
	Bryobia mite Ovicides (O) kill mite eggs and newly hatched mites. Adulticides (A) kill active stages of mites.	bifenazate (A)	UN insecticide	Acramite	7	Apply at not less than 1000 L/ha.
		clofentezine (O)	10A	Apollo SC	21	Apply only once per season.
		fenbutatin oxide (A)	12B	Torque	2	Go to DAFWA website: 'Miticides for WA deciduous fruit trees'.
		maldison (A)	1B	Fyfanon 440EW Malathion 500 E Maldison 500	3	
		paraffin oil (A)	insecticide, spray adjuvant	Biopest Bio clear Trump Spray Oil	1	
		petroleum oil (A)		Biocover		
	Apple weevil (curculio beetle)	alpha-cypermethrin	3A	Various	14	Trunk and butt spray only. Monitor weevil emergence — usually occurs late November. to early December. Continue monitoring after spraying. Summer oil can be added at 1–2% to help prolong activity.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Fruit development to harvest	Fuller’s rose weevil and Apple weevil (curculio beetle)	azinphos-methyl	1B	Gusathion 200 SC Benthion 200 Flowable	14	Apply lower rate as a high volume spray to foliage. Use higher rate as a butt and soil spray only. For weevils apply no more than twice per season. Do not retreat within 10 days. Do not apply for more than 2 consecutive seasons.
		indoxacarb	22A	Avatar		
	Mediterranean fruit fly	Foliar baiting:				
		maldison	1B	Hy-Mal Fyfanon 1000 EC Maldison 500 Maldison 500 EC	3	Go to DAFWA website for latest information.
		spinosad	5	Naturalure Eco-Naturalure	N/A	
		trichlorfon	1B	Dipterex 500 SL Lepidex 500	2	
		Protein to add to baits:				
		yeast autolysate		Fruit Fly Lure Natflav 500	N/A	Add 2 L of protein for every 100 L water + insecticide. Add protein first, then insecticide + water.
		yeast hydrolysate		Flavex		
		Cover spray:				
		clothianidin	4A	Samurai	7	PER14252, expires 30 June 2015. Use with MAXX surfactant.
		fenthion	1B	Lebaycid		PER13840 expires 29 October 2015. Check revised labels following the APVMA review of fenthion.
		spinetoram	5	Delegate		PER12590, expires 31 May 2016.
		trichlorfon	1B	Dipterex 500 SL Lepidex 500	2	Only apply when stung fruit detected.
		thiacloprid	4A	Calypso	21	PER14562, expires 30 November 2018.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	WHP (days)	Comments
Fruit development to harvest	Snails	copper sulphate	unspecified	Bluestone + wetting agent	N/A	Soil and butt spray only.
		iron-EDTA complex	molluscicide	Multiguard Snail and Slug Killer Eradicate		Apply to ground only, place bait close to tree trunk.
		metaldehyde		Various		
		methiocarb	1A	Mesurool Snail and Slug Bait		
	Two-spotted mite	oxythioquinox	14	Morestan	N/A	Other miticides can be used at this stage.
		propargite	12C	Omite 300W		Omite is used only postharvest as it may cause fruit spotting, leaf burn and possible defoliation; this is more likely under hot conditions.
Leaf fall	Pear scab (pears only)	urea		Urea + wetting agent	N/A	Encourages early dormancy, assists with the breakdown of leaf litter and reduces carryover of scab spores.

13. Postharvest treatments for apples and pears

13.1 Fungicides for storage rots

The following fungicides are registered for postharvest dipping of apples and pears. Submerge fruit for approximately 30 seconds. Dipping should occur within 24 hours of harvest.

Reference: Infopest online

Disease controlled	Active ingredient	Fungicide group	Trade names
External rot causing organisms.	Bromochlorodim-ethylhydantoin	sanitiser	Nylate
Controls bacteria and fungi in agricultural and industrial premises, postharvest fruit and vegetable washing and processing facilities.	chlorine as chlorine dioxide	sanitiser	Vibrex Horticare
	chlorine as calcium hypochlorite	sanitiser	Activ 8 Hypochlor Frexus Disinfestation Frexus Duration
Blue mould (<i>Penicillium expansum</i> and <i>P. solitum</i>). Grey mould (<i>Botrytis cinerea</i>).	fludioxonil	12	Scholar
Blue mould (<i>Penicillium expansum</i>).	imazalil	3	Fungazil 500 EC Fungaflor 500 EC Imzacure 500 EC
Blue mould (<i>Penicillium expansum</i>).	imazalil as a sulphate	3	Various
Assists in the control of bacteria and fungi on a range of fruit and vegetables.	iodine	sanitiser	Iodine Granules
Blue mould (<i>Penicillium</i> spp.). Grey mould (<i>Botrytis cinerea</i>). Ripe fruit rot (<i>Gleosporium album</i>).	iprodione	2	Various
Control of bacterial growth in the process water for postharvest processing of fruit and vegetables.	peroxyacetic acid + hydrogen peroxide	sanitiser	Adoxysan Tsunami on Farm
Blue mould (<i>Penicillium expansum</i>). Grey mould (<i>Botrytis cinerea</i>). Fruit rot (<i>Gleosporium album</i>).	thiabendazole	1	Storite Tecto Flowable SC

13.2 DPA (diphenylamine) for superficial scald

DPA is recommended for immersion or drench application to control superficial scald of apple and pear varieties as listed in the table.

Warning: There are many **different rates and recommendations on the label**.

Ensure that the label is read carefully and fully understood.

Reference: Infopest online

Active ingredient	Common trade names	Crop and varieties
diphenylamine	Campbell DPA 310 Scald Inhibitor Chemley No-Scald DPA	Apples: Bonza, Granny Smith, Golden Delicious, Jonathon, Red Delicious, Lady Williams Pears: Nijisseiki(20 th Century), WBC (Bartlett), Packhams Triumph

13.3 Calcium treatments for bitter pit

Calcium chloride will reduce bitter pit on apples which occurs during storage. It may also delay the softening of all varieties during storage.

Several products are available which contain calcium chloride that are suitable for postharvest dipping of apples.

When mixing calcium chloride with fungicides and DPA refer to the label for directions.

The most effective control is achieved by treating fruit within 24 hours of harvest.

Reducing the risk of calcium burn

Calcium chloride treatment of apples can lead to some skin damage. Damage can be minimised if precautions are taken during harvest and postharvest prior to treatment:

- Take all reasonable care to avoid bruising or puncturing the skin during fruit harvesting. Any skin injury is a site for excessive calcium absorption and subsequent damage.
- Avoid treating hot fruit. Never treat fruit with a pulp temperature exceeding 30°C. If necessary, cool fruit with water or delay treatment (never exceed 24 hours).
- Pre-washing fruit and bins prior to treatment for bitter pit or scald is highly recommended. As well as cooling the fruit it will wash dust and soil contamination from the fruit and bins. This will reduce contamination of the dip solution.
- Calcium uptake by the fruit is completed in about 12 hours. Drenching with fresh water soon after this time will remove any risk of further tissue damage from residual calcium chloride on the skin of the apple.

13.4 Other postharvest treatments: Smartfresh™

Smartfresh™ (1-methylcyclopropene – 1-MCP) is registered for postharvest treatment of apples and pears.

Apples: Smartfresh™ maintains fresh picked qualities with improved firmness, protection against skin greasiness and effective control of superficial scald.

Pears: Smartfresh™ maintains quality and appearance through significant decrease of bruising, better stem freshness, control of scald and internal browning.

Smartfresh™ is marketed by AgroFresh Inc., a subsidiary of Rohm and Haas. It is applied using the proprietary Smartfresh delivery system by a registered applicator.

Contact for AgroFresh:

Peter Vedeniapine

Tel: +61 (0)8 9297 1172 or +61 (0)417 779 133

Email: pvedeniapine@agrofresh.com

Website: agrofresh.com

14. Development stages of summer fruit

Photographs by Shane Hetherington, NSW Department of Primary Industries



Dormant



Budswell



Budbreak



Full bloom



Petal fall



Shuck fall

15. Exotic pests of summer fruit

These are our 'targets'



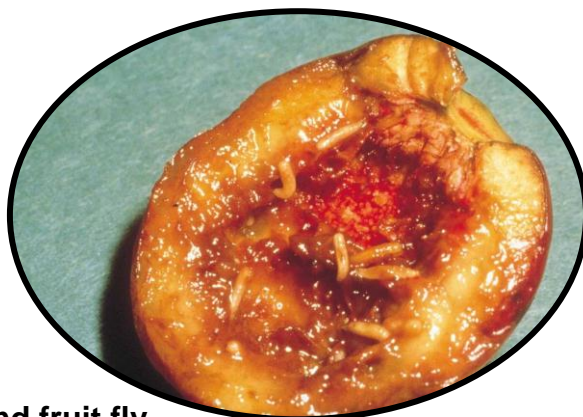
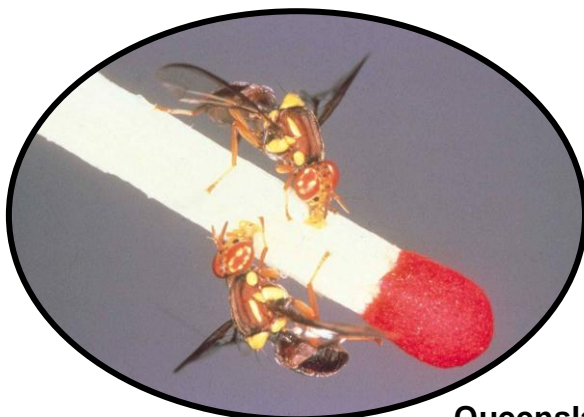
Sharka – Plum pox virus



Cherry aphid



Oriental fruit moth



Queensland fruit fly


16. Summer fruit

16.1 Summer fruit pest and disease monitoring and treatment calendar

Not all these pests will occur in your orchard

NOTE: The pest status of each pest varies across growing districts; monitor to avoid unnecessary or poorly timed spraying.

Pest/disease	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July
Dormancy release												
Shothole, Rust and Freckle												
Leaf curl												
San Jose scale and Frosted scale												
Bryobia mite												
Brown rot												
Snails												
Thrips and Western flower thrips												
Mealybug												
European earwig												
Black and Green peach aphids												
Wingless grasshopper												
Rutherglen bug												
Garden weevil												
Lightbrown apple moth												
Heliothis caterpillar												
Two-spotted mite												
Peach silver mite												
Mediterranean fruit fly												
Apple weevil												
Fuller's rose weevil												
Cherry slug												
Carpophilus beetle												

 Timing for monitoring and treatment if required.

16.2 Summer fruit spray options

Reference: Infopest Online

For extra 'low risk' options for use of pesticides, refer to Section 3.7, page 10.

 Shaded boxes for 'Active ingredients' indicates they are acceptable for organic agriculture.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Dormant	Bacterial canker or bacterial gumosis	copper sulphate + hydrated lime or lime putty	M2	Bordeaux mixture	Summer fruit	1	See NSW DPI Integrated Pest and Disease Management for Australian Summerfruit. Page 14: Bacterial Canker.
		cupric hydroxide + mancozeb	M1 + M3	ManKocide DF		14	
		copper ammonium acetate	M1	Liquicop Cop-IT Copper – Count-N	Apricots, cherries	1	
		cuprous oxide		Agg Copp 750 Nordox 500 Nordox 750 WG Red Copper WG	Apricots, cherries		
		cupric hydroxide		Various			
		copper oxychloride		Various	Summer fruit		
		tri-basic copper sulphate	Tri-Base Blue Cuprofix Disperss Bordeaux WG Tribasic Liquid	Apricots, cherries			
	San Jose scale (continues next page)	chlorpyrifos	1B	Various	Summer fruit	14	It is recommended to combine a dormant oil with any of these insecticides.
		diazinon		Diazinon Diazinon 800 Diazol 800			
		methidathion		Suprathion 400 EC			

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Dormant	San Jose scale (cont.)	paraffinic / petroleum oil	insecticide, spray adjuvant	Various	Summerfruit	1	
	Frosted scale	lime sulphur	M2	Lime Sulphur	Summer fruit (except cherries)	1	
	Dormancy release	fatty acid esters	PGR	Waiken	Cherries	N/A	To advance bud break apply 35–50 days before normal bud break. To retard bud break apply 0–20 days before normal bud break.
Late dormancy to budswell	Bacterial canker or bacterial gummosis	copper sulphate + hydrated lime or lime putty	M1	Bordeaux mixture	Summer fruit	1	See NSW DPI Integrated Pest and Disease Management for Australian Summerfruit. Page 14: Bacterial Canker.
		cupric hydroxide + mancozeb	M1 + M3	ManKocide DF		14	
		copper ammonium acetate	M1	Liquicop Cop-IT Copper - Count-N	Apricots, cherries	1	
		cuprous oxide		Ag Copp 750 Nordox 500 Nordox 750 WG Red Copper WG	Apricots, cherries		
		cupric hydroxide		Various	Summer fruit		
		copper oxychloride		Various			
		tri-basic copper sulphate		Tri-Base Blue Cuprofix Disperss Bordeaux WG Tribasic Liquid	Apricots, cherries		

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Late dormancy to budswell	Bacterial spot	copper oxychloride	M1	Various	Summer fruit	1	
	San Jose scale	azinphos-methyl	1B	Gusathion 200 SC Benthion 200 Flowable	Peaches, nectarines, apricots	14	It is recommended to combine a dormant oil with any one of these insecticides.
		chlorpyrifos		Various	Summer fruit		
		diazinon		Diazinon Diazinon 800 Diazol 800			
		methidathion		Suprathion 400 EC Ridacide 400 EC			
		paraffinic / petroleum oil	insecticide, spray adjuvant	Various		1	
	Frosted scale	lime sulphur	M2	Lime Sulphur	Summer fruit (except cherries)	1	
	Snails	copper sulphate	unspecified	Bluestone	Summer fruit	N/A	Soil and butt spray. Go to DAFWA website: 'Snail and slug control'.
		copper	molluscicide	Escar – Go		1	
		iron EDTA complex		Multiguard Snail and Slug Killer Eradicate		N/A	
		metaldehyde		Various		7	
		methiocarb	1A	Mesurol Snail and Slug Bait			
	Bryobia mite (continues next page)	paraffinic / petroleum oil	insecticide, spray adjuvant	Various	Summer fruit	1	Go to DAFWA website: 'Miticides for WA deciduous fruit trees'.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments	
Late dormancy to budswell	Bryobia mite (cont.)	lime sulphur	M2	Lime Sulphur	Summer fruit (except cherries)	1		
	Leaf curl (continues next page)	copper oxychloride	M1	Various	Peaches, nectarines	1		
		cuprous oxide		Various	Summer fruit			
				Agg Copp 750 Nordox 500 Nordox 750 WG Red Copper WG	Peaches, nectarines			
				cupric hydroxide				Various
		copper octanoate		Tricop				
		chlorothalonil		M5	Various	Peaches		7
		cupric hydroxide + mancozeb	M1 +M3	ManKocide DF	Summer fruit	14		
		dithianon	M9	Delan 700 WG Dragon 700 WG Dithianon 700 WG	Peaches, nectarines	21		
		dodine	M7	Syllit 400SC		N/A		Do not apply after petal fall.
		tri-basic copper sulphate	M1	Tri-Base Blue Cuprofix Disperss Tribasic Liquid Bordeaux WG		1		
		lime sulphur	M2	Lime Sulphur	Summer fruit (except cherries)			
		ziram	M3	Ziram DG	Cherries, nectarines, peaches			7

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Late dormancy to budswell	Leaf curl (cont.)	ziram	M3	Ziram Granuflo	Summer fruit (except apricots)	7	
	Shothole	copper ammonium acetate	M1	Liquicop Cop-IT Copper - Count-N	Summer fruit	1	
		cupric hydroxide		Various			
		cupric hydroxide + mancozeb	M1 + M3	ManKocide DF		14	
		cuprous oxide	M1	Nordox 750 WG Red Copper WG	Summer fruit	1	
				Nordox 500 Agg Copp 750	Summer fruit (except nectarines)		
		copper oxychloride		Various	Summer fruit		
		tri-basic copper sulphate		Tri-Base Blue Cuprofix Disperss Bordeaux WG Tribasic Liquid	Summer fruit		
		dithianon	M9	Delan 700 WG Dragon 700 WG Dithianon 700 WG		21	
		lime sulphur	M2	Lime Sulphur	Summer fruit (except cherries)	N/A	
	Rust	copper oxychloride	M1	Various	Summer fruit	1	
		lime sulphur	M2	Lime Sulphur	Summer fruit (except cherries)	N/A	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Late dormancy to budswell	Freckle (scab)	copper ammonium acetate	M1	Liquicop Cop-IT Copper - Count-N	Apricots	1	
		cuprous oxide		Ag Copp 750 Nordox 500 Nordox 750 WG Red Copper WG			
		cupric hydroxide		Various			
		copper oxychloride		Various			
		tri-basic copper sulphate		Tri-Base Blue Tribasic Liquid Bordeaux WG Cuprofix Disperss			
		lime sulphur	M2	Lime Sulphur	Summer fruit (except cherries)	N/A	
Budburst/ pink bud to fruit development	Brown rot (continues next page)	captan	M4	Various	Summer fruit (except apricots)	7	See NSW DPI Integrated Pest and Disease Management, page 27: 'Blossom blight and brown rot'.
		chlorothalonil	M5	Various	Summer fruit Plums	7 1	See 'Additional Restraints for stonefruits' on label.
		dodine	M7	Syllit 400SC	Peaches, nectarines	N/A	Do not apply after petal fall
		iprodione	2	Various	Summer fruit	Nil	
		mancozeb	M3	Various	Summer fruit	14	May be phytotoxic to some plum varieties. Test new plum varieties on a small scale before applying to entire crop.
		penthiopyrad	7	Fontelis	Summer fruit	Nil	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Budburst/ pink bud to fruit development	Brown rot (cont.)	propiconazole	3	Various	Summer fruit	1	
		sulfur	M2	Various	Summer fruit (except apricots)	1	
		thiram	M3	Thiragranz Thiram DG Thiram WP	Summer fruit	7	
		triforine	3	Saprol		1	
		ziram	M3	Ziram DG Ziragranz	Cherries, nectarines peaches	7	
				Ziram Granuflo	Summer fruit (except apricots)		
	Leaf curl	chlorothalonil	M5	Various	Peaches	7	See 'Additional Restraints for stonefruits' on label.
		dodine	M7	Syllit 400SC	Peaches, nectarines	5	Do not apply after petal fall.
		ziram	M3	Ziram DG	Peaches, cherries, nectarines	7	
				Ziram Granuflo	Summer fruit (except apricots)		
	Shothole (continues next page)	chlorothalonil	M5	Various	Summer fruit	7	See 'Additional Restraints for stonefruits' on label.
					Plums	1	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Budburst / pink bud to fruit development	Shothole (cont.)	mancozeb	M3	Various	Summer fruit	14	May be phytotoxic to some plum varieties. Test new plum varieties on a small scale before applying to entire crop.
		metiram		Polyram DF	Summer fruit		
		ziram		Ziram DG Ziram Granuflo	Summer fruit (except apricots)	7	
	Freckle (scab)	chlorothalonil	M5	Various	Apricots	7	See 'Additional Restraints for stonefruits' on label.
		dithianon	M9	Delan 700 WG Dithianon 700 WG Dragon 700 WG	Apricots, nectarines, peaches	21	
		mancozeb	M3	Various	Summer fruit	14	May be phytotoxic to some plum varieties. Test new plum varieties on a small scale before applying to entire crop.
		penthiopyrad	7	Fontelis	Summer fruit	Nil	
		thiram	M3	Thiram WP Thiram DG Thiragranz	Apricots, cherries, peaches	7	
	Rust	chlorothalonil	M5	Various	Summer fruit (except nectarines)	7	See 'Additional Restraints for stonefruits' on label.
		mancozeb	M3	Various	Summer fruit	14	May be phytotoxic to some plum varieties. Test new plum varieties on a small scale before applying to entire crop.
		metiram		Polyram DF	Summer fruit		

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Budburst / pink bud to fruit development	Aphids, Black peach aphid or Green peach aphid	clothianidin	4A	Samurai	Peaches, nectarines	21	Ensure that a reasonable amount of leaf is present at spraying to enhance uptake.
		fatty acids - K salt	insecticide	Natrasoap Hitman Bug Guard	Summer fruit	N/A	
		imidacloprid		Various	Summer fruit	21	Apply as a full cover spray ensuring thorough coverage.
		maldison	1B	Various		3	
		methomyl	1A	Various	Summer fruit (cherries, nectarines, peaches)	1	
		pirimicarb		Various	Summer fruit	2	Use at least 1,100 L spray/ha.
		pymetrozine	9B	Chess Endgame Metro 250WP	Summer fruit	28	
	Black peach aphid	spirotetramat	23	Movento	Summer fruit	21	To ensure there is sufficient foliage for product uptake do not apply prior to shuck fall. Apply with surfactant – refer to label for details.
	Tuber mealybug and Longtailed mealybug	spirotetramat	23	Movento	Summer fruit	21	To ensure there is sufficient foliage for product uptake do not apply prior to shuck fall. Apply with surfactant – refer to label for details.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Budburst / pink bud to fruit development	European earwig	chlorpyrifos	1B	Various	Summer fruit	14	Chlorpyrifos can be applied as a foliar spray or combined with sunflower oil and cracked grain to be applied as a ground bait.
		carbaryl	1A	Bugmaster Flowable Carbaryl 500 SC	Summer fruit (except cherries)	35	Go to DAFWA website: 'Management of European earwig'. Monitor for this pest using single-sided corrugated cardboard trunk bands. Continue monitoring throughout season.
		indoxacarb	22A	Avatar	Cherries	14	PER11002, valid to 31 Mar 2015.
	Thrips	fatty acids – potassium salts	insecticide	BugGuard Hitman Natrasoap	Summer fruit	N/A	Go to DAFWA website: 'Thrips pests in pome and stone fruit'.
		methomyl		1A	Lannate L Electra 225	Summer fruit	
			Various		Cherries, nectarines, peaches		
		pyrethrins + piperonyl butoxide	3A	Py-Bo	Summer fruit		
		tau-fluvalinate		Mavrik Aquaflo Klartan	Nectarines, peaches, plums, cherries	N/A	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Fruit development to harvest	Western flower thrips	spinetoram	5	Delegate	Summer fruit	3	Check label for WFT resistance strategy. Go to DAFWA website: 'Chemical control of western flower thrips'.
	Bacterial canker or bacterial gummosis	copper ammonium acetate	M1	Liquicop Copper - Count-N Cop-IT	Apricots cherries	1	These copper formulations are registered to be used 7 days after petal fall and repeated 7-10 days later.
		cuprous oxide		Agg Copp 750 Nordox 750 WG Red Copper WG Nordox 500	Apricots, cherries		
		copper oxychloride		Various	Apricots, cherries		
		cupric hydroxide		Various	Apricots, cherries		
		tri-basic copper sulphate		Tri-Base Blue Cuprofix Disperss Bordeaux WG Tribasic Liquid	Apricots, cherries		
	Garden weevil	alpha-cypermethrin	3A	Various	Summer fruit (except cherries)	14	Trunk and butt spray only.
		indoxacarb	22A	Avatar	Summer fruit (except cherries)	7	Refer to weevil section in 'Common Pests of Summer fruit in WA'.
	Leaf curl	chlorothalonil	M5	Various	Peaches	7	See 'Additional Restraints for stonefruits' on label.
		ziram	M3	Ziram DG Ziram Granuflo	Summer fruit (except apricots)		

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Fruit development to harvest	Shothole	chlorothalonil	M5	Various	Summer fruit	7	See 'Additional Restraints for stonefruits' on label.
					Plums	1	
		dithianon	M9	Delan 700 WG Dithianon 700 WG Dragon 700 WG	Summer fruit	21	
		mancozeb	M3	Various	Summer fruit	14	May be phytotoxic to some plum varieties. Test new plum varieties on a small scale before applying to entire crop.
		thiram		Thiram DG Thiragranz	Summer fruit	7	
		ziram		Ziram DG Ziram Granuflo	Summer fruit (except apricots)		
	Rust (continues next page)	chlorothalonil	M5	Various	Summer fruit (except nectarines)	7	See 'Additional Restraints for stonefruits' on label.
		dithianon	M9	Delan 700 WG Dithianon 700 WG Dragon 700 WG	Peaches, plums, nectarines	21	
		mancozeb	M3	Various	Summer fruit	14	May be phytotoxic to some plum varieties. Test new plum varieties on a small scale before applying to entire crop.
		propiconazole	3	Various	Plums	1	Label specifies plums for prune production.
		sulfur	M2	Various	Summer fruit (except apricots)	N/A	Can be applied 4 weeks after petal fall.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Fruit development to harvest	Rust (cont.)	sulfur	M2	Thiovit Jet	Peaches, nectarines, plums	N/A	
		zineb	M3	Zineb	Peaches, nectarines, plums	14	
	Freckle (scab)	chlorothalonil	M5	Various	Apricots	7	See 'Additional Restraints for stonefruits', on label.
		dithianon	M9	Delan 700 WG Dithianon 700 WG Dragon 700 WG	Apricots, nectarines, peaches	21	May be phytotoxic to some plum varieties. Test new plums varieties on a small scale before applying to entire crop.
		mancozeb	M3	Various	Summer fruit	14	
		penthiopyrad	7	Fontelis	Summer fruit	Nil	
		thiram	M3	Thiragranz Thiram DG Thiram WP	Apricots, cherries, peaches	7	
		ziram		Ziram DG Ziram Granuflo	Summer fruit (except apricots)		
		Wingless grasshopper (continues next page)	carbaryl	1A	Bugmaster Flowable Carbaryl 500 SC	Summer fruit (except cherries)	35
	Cricket and Grasshopper Killer Bait				Summer fruit	7	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Fruit development to harvest	Wingless grasshopper (cont.)	indoxacarb	22A	Avatar	Summer fruit (except cherries)	7	
		<i>Metarhizium anisopliae</i>	biological insecticide	Green Guard SC	Summer fruit	N/A	For best results, apply when grasshoppers are at early nymph stage. Refer to label for details of application.
	Rutherglen bug	trichlorfon	1B	Dipterex 500 SL Lepidex 500	Summerfruit	2	It is recommended to spray nearby weeds.
	Bryobia mite	azinphos-methyl	1B	Benthion 200 Flowable Gusathion 200 SC	Summer fruit	14	Go to DAFWA website: 'Miticides for WA deciduous fruit trees'.
		bifenazate	UN	Acramite	Summer fruit (except cherries)	3	
		fenbutatin oxide	12B	Torque Vendex	Peaches, nectarines	14	
	San Jose Scale (crawlers)	chlorpyrifos	1B	Various	Summer fruit	14	
		diazinon		Diazinon 800 Diazinon Diazol 800			
		paraffinic oil	insecticide, spray adjuvant	Biopest Bioclear Trump Spray Oil	Summer fruit	1	
		spirotetramat	23	Movento	Summer fruit	21	

To ensure there is sufficient foliage for product uptake do not apply prior to shuck fall. Apply with surfactant – refer to label for details.

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Fruit development to harvest	Apple weevil	alpha-cypermethrin	3A	Various	Summer fruit (except cherries)	14	Refer to weevil section in 'Common Pests of Summer Fruit in WA'.
		azinphos-methyl	1B	Gusathion 200 SC Benthion 200 Flowable	Peaches, nectarines, apricots		Can be applied as a butt spray or as a foliage spray — check label for correct rates.
		indoxacarb	22A	Avatar	Summer fruit (except cherries)	7	
	Fuller's rose weevil	azinphos-methyl	1B	Gusathion 200 SC Benthion 200 Flowable	Peaches, nectarines, apricots	14	Can be applied as a butt spray or as a foliage spray — check label for correct rates.
		indoxacarb	22A	Avatar	Summer fruit (except cherries)	7	Refer to weevil section in 'Common Pests of Summer fruit in WA'.
	Lightbrown apple moth (continues next page)	azinphos-methyl	1B	Gusathion 200 SC Benthion 200 Flowable	Summer fruit	14	
		<i>Bacillus thuringiensis</i>	11C	Various	Summer fruit	Nil	Read 'Critical Comments' on label.
		carbaryl	1A	Bugmaster Flowable Carbaryl 500 Flowable Carbaryl 500 SC	Summer fruit (except cherries)	35	
		chlorpyrifos	1B	Strike-out 500 WP Cyren 500 WP	Summer fruit	14	
				Lorsban 750 WG	Summer fruit (except cherries)		
		chlorantraniliprole	28	Altacor	Summer fruit		

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Fruit development to harvest	Lightbrown apple moth (cont.)	indoxacarb	22A	Avatar	Summer fruit (except cherries)	7	Best results achieved when Avatar treatments are applied consecutively.
		pyrethrins + piperonyl butoxide	3A	Py-Bo	Summer fruit	1	
		spinetoram	5	Delegate	Summer fruit	3	Target sprays against mature eggs and newly-hatched larvae.
	Heliothis (native budworm)	<i>Bacillus thuringiensis</i>	11C	Various	Summer fruit	Nil	Read 'Critical Comments' on label.
		carbaryl	1A	Bugmaster Flowable Carbaryl 500 SC	Summer fruit (except cherries)	35	
		indoxacarb	22A	Avatar	Summer fruit (except cherries)	7	
		methomyl	1A	Various	Peaches, nectarines	1	
		pyrethrins + piperonyl butoxide	3A	Py-Bo	Summer fruit		
	Looper caterpillars	<i>Bacillus thuringiensis</i>	11C	Various	Summer fruit	Nil	Read 'Critical Comments' on label.
		pyrethrins + piperonyl butoxide	3A	Py-Bo	Summer fruit	1	
	Cherry slug (continues next page)	azinphos-methyl	1B	Gusathion 200 SC Benthion 200 Flowable	Summer fruit (except plums)	14	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments	
Fruit development to harvest	Cherry slug (cont.)	carbaryl	1A	Bugmaster Flowable Carbaryl 500 Flowable Carbaryl 500 SC	Summer fruit (except cherries)	35	Go to DAFWA website: 'Miticides in WA deciduous fruit trees'.	
		spinetoram	5	Delegate	Summer fruit	3		
	Two-spotted mite (continues next page) Ovicides (O) kill mite eggs and newly hatched mites. Adulticides (A) kill active stages of mites	bifenazate (A)	UN	Acramite	Summer fruit (except cherries)	3		
		chlorfenapyr (A)	13	Secure 360 SC	Peaches	7		
		clofentazine (O)	10A	Apollo SC	Summer fruit	21		
		etoxazole (O)	10B	Paramite	Summer fruit (except cherries)			
		fatty acids – K salts (A)	unspecified	BugGuard Hitman Natrasoap	Summer fruit	N/A		
		fenbutatin oxide (A)	12B	Torque	Peaches Nectarines	14		
		hexythiozox (O)	10A	Calibre 100 EC Hexythiazox 100 EC	Summer fruit	3		
		milbemectin (O,A)	6B	Milbeknock	Summer fruit	14		
		oxythioquinox (A)	14	Morestan	Peaches	N/A	Can only be applied postharvest.	
		petroleum oil (O,A)	insecticide, spray adjuvant	Biocover	Summer fruit	1	Check label for rates and conditions.	
		paraffin oil (O,A)		Biopest Trump Spray Oil				
				Bioclear	Summer fruit (except Apricots & cherries)			

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Fruit development to harvest	Two-spotted mite (cont.)	propargite (A)	12C	Omite 300 W Betamite 300 WG Omite Unimite 300 W	Summer fruit	7	
	Brown rot (continues next page)	captan	M4	Various	Summer fruit (except apricots)	7	See NSW DPI Integrated Pest and Disease Management for Australian Summer Fruit pg 27 Blossom blight and brown rot.
		chlorothalonil	M5	Various	Summer fruit	7	See 'Additional Restraints for stonefruits' on label.
		iprodione	2	Various		Nil	
		mancozeb	M3	Various		14	May be phytotoxic to some plum varieties. Advisable to test any new plum varieties on a small scale before applying to entire crop
		penthiopyrad	7	Fontelis		Nil	
		propiconazole	3	Various		1	
		sulfur	M2	Various	Summer fruit (except apricots)	N/A	
		thiram	M3	Thiram DG Thiram WP Thiragranz	Summer fruit	7	
		triforine	3	Saprol	Summer fruit	1	
		ziram	M3	Ziram DG Ziragranz	Cherries, nectarines, peaches	7	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments	
Fruit development to harvest	Brown rot (cont.)	ziram	M3	Ziram Granuflo	Summer fruit (except apricots)	7		
	Mediterranean fruit fly (continues next page)	Foliar baiting:						
		trichlorfon	1B	Dipterex 500 SL Lepidex 500	Summer fruit	2	Go to DAFWA website for the latest information	
		maldison		Fyfanon 400 EW Hy-Mal Maldison 500 Maldison 500 EC		3		
		spinosad	5	Eco-Naturalure Naturalure		N/A		
		Protein to add to baits:						
		Yeast autolysate		Fruit Fly Lure Natflav 500	Summer fruit	N/A	Add 2 L of protein for every 100 L water + insecticide. Add protein first, then insecticide + water.	
		Yeast hydrolysate		Flavex				
		Cover spray:						
		clothianidin	4A	Samurai	Summer fruit	7	PER14252 expires 30 June 2015. Use with Maxx surfactant.	
		fenthion	1B	Lebaycid	Nectarines Plums	14	PER13840 expires 20 October 2015. Check revised labels following the APVMA review of fenthion.	
					Cherries	7		
		maldison		Fyfanon 440 EW Fyfanon 1000 EC Hy-Mal	Summerfruit	3	PER12907, expires 31 May 2016	
		spinetoram	5	Delegate			PER12590, expires 31 May 2016.	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Fruit development to harvest	Mediterranean fruit fly (cont.)	thiacloprid	4A	Calypso	Summerfruit	14	PER14562 expires 30 November 2018.
					Peaches	21	
		Carpophilus beetle (dried fruit beetle)	bifenthrin	3A	Various	Summer fruit (except cherries)	1
Postharvest to leaf fall	Bacterial canker or bacterial gummosis	cupric hydroxide + mancozeb	M1 + M3	ManKocide DF	Summer fruit	N/A	See NSW DPI Integrated Pest and Disease Management for Australian Summer fruit. Page 14: 'Bacterial canker'.
		copper ammonium acetate	M1	Liquicop Copper - Count-N Cop-IT	Apricots, cherries		
		cuprous oxide		Nordox 500 Agg Copp 750 Nordox 750 WG Red Copper WG	Apricots, cherries		
		cupric hydroxide		Various			
		copper oxychloride		Various	Summer fruit		
		tri-basic copper sulphate		Tri-Base Blue Cuprofix Disperss Bordeaux WG Tribasic Liquid	Apricots, cherries		
	Leaf curl (continues next page)	cuprous oxide	M1	Nordox 500 Agg Copp 750 Nordox 750 WG Red Copper WG	Peaches, nectarines	N/A	
		cupric hydroxide	M1	Various	Peaches, nectarines	N/A	

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Postharvest to leaf fall	Leaf curl (cont.)	cupric hydroxide + mancozeb	M1 + M3	ManKocide DF	Summer fruit	N/A	
		copper oxychloride	M1	Various	Summer fruit		
		tri-basic copper sulphate		Tri-Base Blue Cuprofix Disperss Bordeaux WG Tribasic Liquid	Peaches, nectarines		
	Shothole	copper ammonium acetate	M1	Liquicop Cop-IT Copper - Count-N	Summer fruit	N/A	
		cupric hydroxide		Various			
		cuprous oxide		Nordox 750 WG Red Copper WG	Summer fruit		
				Nordox 500 Agg Copp 750	Summer fruit (except nectarines)		
		copper oxychloride		Various	Summer fruit		
		cupric hydroxide + mancozeb	M1 + M3	ManKocide DF			
		tri-basic copper sulphate	M1	Tri-Base Blue Cuprofix Disperss Bordeaux WG Tribasic Liquid			
		Freckle (continues next page)	copper ammonium acetate	M1	Liquicop Cop-IT Copper - Count-N		

Spray timing	Pest or disease	Active ingredient	Chemical class	Common trade names	Crop	WHP (days)	Comments
Postharvest to leaf fall	Freckle (cont.)	cuprous oxide		Agg Copp 750 Nordox 500 Nordox 750 WG Red Copper WG	Apricots	N/A	
		cupric hydroxide	M1	Various	Apricots	N/A	
		copper oxychloride		Various			
		tri-basic copper sulphate		Tri-Base Blue Cuprofix Disperss Bordeaux WG Tribasic Liquid			
	Snails	copper sulphate	unspecified	Bluestone	Summer fruit	N/A	
		iron EDTA complex	molluscicide	Multiguard Snail and Slug Killer Eradicate			
		metaldehyde		Various			
		methiocarb	1A	Mesuroil Snail and Slug Bait			
		silicate salts + copper	Unspecified	Socusil Snail Repellent			

17. Postharvest treatments for summer fruit

When dipping summer fruit, fruit should be submerged to allow sufficient time to thoroughly wet the fruit, approximately 30 seconds. Fungicide treatments should be applied as soon as is practical after harvest, usually within 24 hours.

Reference: Infopest Online

Pest or disease controlled	Active ingredient	Common trade	Chemical class	Crop
External rot causing organisms	bromochlorodimethylhydantoin	Nylate	sanitiser	Summer fruit
Controls bacteria and fungi in agricultural and industrial premises, postharvest fruit and vegetables washing and processing facilities.	chlorine as chlorine dioxide	Vibrex Horticare	sanitiser	Summer fruit
	chlorine as calcium hypochlorite	Active 8 Hypochlor Frexus Disinfestation Frexus Duration	sanitiser	Summer fruit
Brown rot (<i>Monilinia</i> spp.) Grey mould (<i>Botrytis cinerea</i>). Rhizophos rot (<i>Rhizopus stolonifer</i>).	fludioxonil	Scholar	12	Summer fruit
To assist in the control of bacteria and fungi on a range of fruit and vegetables.	iodine	Iodine Granules	sanitiser	Summer fruit
Brown rot (<i>Monilinia</i> spp.). Transit rot (<i>Rhizopus stolonifer</i>).	iprodione	Various	2	Summer fruit
Postharvest treatment of certain fruits and vegetables for improved quality after shipping, storage or handling. Smartfresh™ is applied by use of a proprietary delivery system.	1-methylcyclopropene	Smartfresh™	PGR	Plums
Control of bacterial growth in the process water for postharvest processing of fruit and vegetables.	peroxyacetic acid + hydrogen peroxide	Adoxysan Tsunami on Farm	sanitiser	Summer fruit
Brown rot (<i>Monilinia</i> spp.).	triforine	Saprol	3	Summer fruit

18. Herbicide guide for deciduous orchards in WA

Definitions

Knockdown herbicides control established weeds only. They may be **contact**, only burn off those parts of the plant contacted or **systemic**, absorbed and translocated throughout the plant for a total kill.

Pre-emergent or **residual herbicides** control germinating weed seeds before they emerge, but some can be effective up to the two-leaf stage. Control relies on a barrier of chemical in the surface of the soil.

Key: Knockdown herbicide = ☐ Residual herbicide = ☐

Reference: Infopest Online

Weeds controlled	Active ingredient	Chemical class	Common trade names	Crop	Comments
annual and perennial grasses	2,2 DPA	J	Altapon 2,2 –DPA Dalapon 740 SP	Pome fruit, summer fruit	Knockdown, systemic herbicide. DO NOT apply to trees under 4 years old. Best results with half rate at 4–6 week interval.
broad-leaf weeds, grasses and couch	amitrole + ammonium thiocyanate	Q	Various	Pome fruit, summer fruit	Knockdown, systemic herbicide, absorbed mainly through leaves. Do not apply less than 56 days before harvest.
annual broad-leaf and grasses	amitrole + paraquat dichloride	LQ	Alliance	Pome fruit, summer fruit	Can be combined with residual herbicides for longer term control.
dock	asulam	K	Various	Apples	Narrow-spectrum knockdown herbicide.
various broad-leaf weed species	carfentrazone-ethyl	G	Various	Summer fruit	Can be used for desuckering or combined with a knockdown herbicide. Refer to label.
grass weeds only	clethodim	A	Various	Non-bearing fruit trees	

Weeds controlled	Active ingredient	Chemical class	Common trade names	Crop	Comments
annual grasses and broad-leaf weeds	dichlobenil	K	Casoron G Sierraron G	Apples, apricots, peaches, plums	Pre-emergent granular herbicide
capeweed	diquat	L	Various	Pome fruit, summer fruit	Can be useful under heavy infestations. Refer to label.
grasses only	fluazifop-p-butyl	A	Fusilade Forte	Pome fruit, summer fruit	Knockdown, systemic herbicide.
broad spectrum, good on broad-leaf weeds and clovers	glufosinate-ammonium	N	Various	Pome fruit, summer fruit	Partially systemic knockdown herbicide. Do not use on trees less than 2 years old unless shielded from spray drift. Withholding period of 21 days applies for pome and summer fruit orchards.
broad spectrum, both annual and perennial	glyphosate	M	Various	Pome fruit, summer fruit	Knockdown, systemic herbicide. Do not use on trees less than 3 years old unless shielded from spray drift. Lower rates are intended for annual weeds and the higher rates are for perennial weeds. For the best rate refer to label recommendations.
broad spectrum, both annual and perennial	glyphosate + carfentrazone-ethyl	M + G	Broadway	Pome fruit, summer fruit	Improved broad-leaf control, especially marshmallow.
annual and perennial grasses	haloxyfop-r-methyl	A	Various	Pome fruit, summer fruit	Knockdown herbicide. Check label for optimum rates. The addition of an adjuvant is important.

Weeds controlled	Active ingredient	Chemical class	Common trade names	Crop	Comments
broad-leaf weeds	isoxaben	K	Gallery 750	Pome fruit, summer fruit	Pre-emergent. Requires rain/irrigation (12.5 mm) within 21 days to activate it.
annual grasses, good on crab-grass	napropamide	K	Devrinol WG	Summer fruit	Residual herbicide. Requires mechanical incorporation or 20 mm rainfall/irrigation within 10 days of application.
annual grasses and broad-leaf weeds	norflurazon	F	Zoliar DF Zoliar 800 DF	Pome fruit summer fruit	Residual herbicide. Apply before weed emergence, can be tank mixed with a knockdown. Do not use more than 5 kg/ha per season.
grasses and broad- leaf weeds	oryzalin	D	Various	Pome fruit, summer fruit	Residual herbicide. Apply to soil free of weeds and trash. Requires rain/irrigation (12.5 mm) within 21 days to activate it.
annual grasses and broad-leaf weeds	oxyfluorfen	G	Various	Pome fruit, summer fruit	Residual herbicide. Do not use after budswell or on apples and pears if less than 3 years old. Apply to freshly cultivated weed-free soil. Addition of oxyfluorfen to glyphosate, paraquat or diquat improves knockdown control and increases the speed of activity. These combinations can be used all year.
annual grasses and broad-leaf weeds	paraquat	L	Various	Pome fruit, summer fruit	
annual grasses and broad leaf weeds	paraquat + diquat	L	Various	Pome fruit, summer fruit	Knockdown, contact herbicide. If water volume exceeds 200 L/ha add non-ionic surfactant at label rates.

Weeds controlled	Active ingredient	Chemical class	Common trade names	Crop	Comments
annual grasses and broad-leaf weeds	pendimethalin	D	Various	Pome fruit, summer fruit	Residual herbicide. Apply to soil free of weeds and trash. Requires rain/irrigation (5 mm) within 10 days to activate it.
seedling weeds and grasses	pine oil	Organic	Bioweed	Pome fruit, summer fruit	Suitable for organic production. For more info visit certifiedorganics.info
Broad-leaf weeds	saflufenacil	G	Sharpen WG	Pome fruit	Do not use on trees less than 3 years old unless shielded from spray drift.
annual broad-leaf weeds	simazine	C	Various	Pome fruit	Residual herbicide. Apply to a bare moist soil. Do not use if trees less than 2 years old.
annual grasses and broad leaf weeds (good on ryegrass and wire-weed).	trifluralin	D	Various	Pome fruit, summer fruit	Residual herbicide. Do not use after budswell. Must be incorporated within 4 hours, so is best suited as a pre-plant treatment.

19. Example of a spray diary

Date	Block	Variety	Growth stage	Target pest	Registered product	Product rate		Water rate L/ha	Comments (e.g. temperature, rainfall, wind direction, wind speed, tractor speed, operator effectiveness)
						/ha	/100 L		

Donnybrook Farm Service Ad insert – back page

Department of Agriculture and Food, Western Australia
3 Baron-Hay Court, South Perth, Western Australia
Postal address: Locked Bag 4, Bentley Delivery Centre WA 6983
Tel: +61 (0)8 9368 3333 Fax: +61 (0)8 9474 2405
agric.wa.gov.au