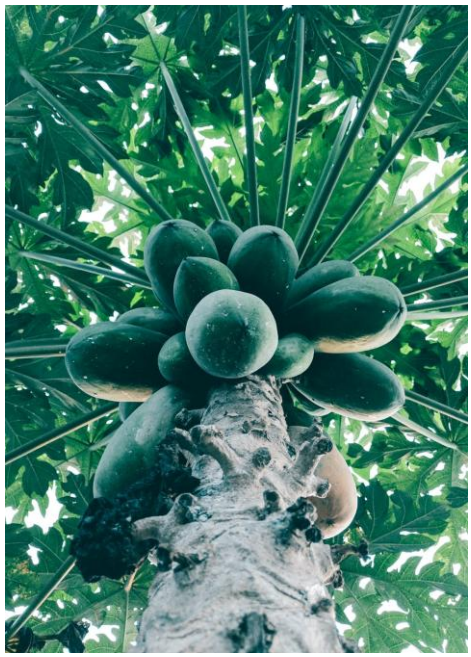

Papaya

Strategic Agrichemical Review Process (SARP)

January 2025

Hort Innovation
Project – MT23001

Hort Innovation Project Number:
MT23001 – Strategic Agrichemical Review Process (SARP) - Updates

SARP Service Provider:
AGK Services

Purpose of the report:
This report was funded by Hort Innovation to investigate the pest problem, agrichemical usage and pest management alternatives for the papaya industry across Australia. The information in this report will assist the industry with its agrichemical selection and usage into the future.

Date of report:
January 2025

Disclaimer:
Hort Innovation makes no representations and expressly disclaims all warranties (to the extent permitted by law) about the accuracy, completeness, or currency of information in the papaya industry SARP Report. Users of this material should take independent action before relying on its accuracy in any way.

Reliance on any information provided by Hort Innovation is entirely at your own risk. Hort Innovation is not responsible for, and will not be liable for, any loss, damage, claim, expense, cost (including legal costs) or other liability arising in any way (including from Hort Innovation or any other person's negligence or otherwise) from your use or non-use of the papaya industry SARP Report, or from reliance on information contained in the material or that Hort Innovation provides to you by any other means.

Communications Manager
Hort Innovation
Level 7, 141 Walker Street
North Sydney NSW 2060
Australia
Email: communications@horticulture.com.au
Phone: 02 8295 2300

Hort Innovation PAPAYA FUND

This project has been funded by Hort Innovation using the papaya research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Table of Contents

1. Summary

The strategic levy investment project Strategic Agrichemical Review Process (SARP) - Updates (MT23001) is part of the Hort Innovation Papaya Fund. A Strategic Agrichemical Review Process (SARP), through the process of a desktop audit and industry liaison; Assesses the importance of the diseases, insects and weeds (plant pests) that can affect a horticultural industry;

(i) Assesses the importance of the diseases, insects and weeds (plant pests) that can affect a horticultural industry;
(ii) Evaluates the availability and effectiveness of fungicides, insecticides and herbicides (pesticides) to control the plant pests;
(iii) Determines any gaps in the pest control strategy and
(iv) Identifies suitable new or alternatives pesticides to address the gaps.

Alternative pesticides should ideally be selected for benefits of:

- Integrated Pest Management (IPM) compatibility
- Improved scope for resistance management
- Sound biological profile
- Residue and trade acceptance domestically and for export

The results of this process will provide the Papaya Industry with sound pesticide usage for the future that the industry can pursue for registration with the manufacturer, or minor-use permits with the Australian Pesticide and Veterinary Medicines Authority (APVMA).

1.1 Diseases

The high priority diseases are:

Disease	Priority
Phytophthora Root Rot (*Phytophthora* spp.)	H
Phytophthora Fruit Disease (*Phytophthora* spp.)	H
Black Spot (*Asperisporium caricae*)	H
Brown Spot (*Corynespora cassiicola*)	H
Anthracnose (*Colletotrichum gloeosporioides*)	H

1.2 Insects and other pests

The high priority insects and other pests are:

Insects and Other Pests	Priority
Fruit Spotting Bug (*Amblypelta nitida*)	H
Banana Spotting Bug (*Amblypelta lutescens*)	H
Two Spotted Mite (*Tetranychus urticae*)	H
African Spider Mite (*Eutetranychus africanus*)	H
Papaya Mealy Bug (*Paracoccus marginatus*)	H

1.3 Weeds

The high priority weeds are:

Weeds	Priority
Nutgrass (*Cyperus rotundus*)	H
Flaxleaf Fleabane (*Conyza bonariensis*)	H
Mexican Clover (*Richardia brasiliensis*)	H
Blackberry Nightshade (*Solanum nigrum*)	H
Silverleaf Nightshade (*Solanum elaeagnifolium*)	H
Bellvine (*Ipomoea plebeia*)	H

1.4 Plant Growth Regulators

The high priority Plant Growth Regulator issues are:

PGR Issue	Priority
Post-harvest ripening	H

2. The Australian Papaya Industry

As a tropical fruit, red papaya and yellow pawpaw production predominantly occurs in the north of Australia, in Queensland, as well as production in the Northern Territory and Western Australia. All production is essentially consumed in the domestic market, with 99% sold into the fresh market and 1% into processing. Australia also imports a small quantity of papaya each year, almost exclusively from Fiji.

Production for the year ending June 2023 was 21,760 tonnes. The value of production was worth $39 million, with the wholesale value of fresh supply worth $45.8 million. Production and revenue are reasonably stable from year to year.

There are currently two main categories grown in Australia. Red Papaya accounts for 85% of fresh production and yellow pawpaw accounts for 15% of fresh production.

Fresh Papaya Seasonality by State[1]

State	22/23 Tonnes	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Queensland	18,496												
Western Australia	1,741												
Northern Territory	1,523												
Availability Legend			High			Medium			Low			None	

The minor export volumes of fresh papaya (7 tonnes for the year ending June 2023) are destined for New Zealand (48%), Brunei, Hong Kong and Singapore (14% each).

[1] Hort Innovation (2024). Australian Horticulture Statistics Handbook 2022/23. [online] Available at: https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/australian-horticulture-statistics-handbook/

3. Introduction

3.1 Background

Growers of some horticultural crops suffer from a lack of legal access to crop protection products (pesticides). The problem may be that whilst a relatively small crop area is valuable in an agricultural sense, it may not be of sufficient size for Agrichemical companies to justify the expense of registering a product use on that crop. Alternately, the disease, pest, or weed problem may be regional or spasmodic, making Agrichemical companies unwilling to bear the initial high cost of registering suitable pesticides.

Growers may face severe losses from diseases, pests and weeds due to a lack of registered or approved (via a permit) chemical control tools.

Environmental concerns, consumer demands, and public opinion are also significant influences in the marketplace related to pest management practices. Industry IPM practitioners must strive to implement best management practices and tools to incorporate a pest management regime where strategies work in harmony with each other to achieve the desired effects while posing the least risks.

In combination with cultural practices, pesticides are important tools in papaya production and respective IPM programs. They control the various diseases, insects and weeds that affect the crop and can cause severe economic loss in modern high intensity growing operations. Pesticides are utilised during establishment and development, and to maximise quality and customer appeal.

As a consequence of the issues facing the papaya industry regarding pesticide access, Hort Innovation has undertaken the current project to update the Strategic Agrichemical Review Process (SARP) for papaya.

The SARP process identifies diseases, insect pests and weeds of major concern to the papaya industry. Against these threats, available registered or permitted pesticides are evaluated for overall suitability in terms of IPM, resistance, efficacy, trade, human safety and environmental issues. Where tools are unavailable or unsuitable the process aims to identify potential future solutions. Potential new risks to the industry are also identified.

The results will provide the papaya industry with a clear outlook of gaps in existing pest control options. This report is not a comprehensive assessment of ALL pests and control methods used in papaya but attempts to prioritise the major problems.

Exotic plant pests, not present in Australia, are not addressed in this document. Biosecurity plans have been developed for the Papaya Industry in consultation with industry, government and scientists. The Biosecurity Plan outlines key threats to the industry, risk mitigation plans, identification and categorisation of exotic pests and contingency plans. High priority exotic pests have been assessed based on their potential to enter, establish, and spread in Australia (e.g. environmental factors, host range, vectors) and the cost to industry of control measures. More information is available at this link[2].

[2] https://www.planthealthaustralia.com.au/industries/

3.2 Minor use permits and registration

From a pesticide access perspective, the APVMA classifies papaya as a minor crop. They fit within the APVMA Crop Group 006: Assorted tropical & sub-tropical fruits - inedible peel and the subgroup 006B: Assorted tropical & sub-tropical, inedible smooth peel - large. Access to minor use permits can be achieved as long as a reasonable justification is provided in accordance with the APVMA's minor use guidance[3]. Possible justification for future permit applications could be based on:

- New disease, insect or weed identified as a cropping issue
- No pesticide approved for the problem
- Insufficient options for resistance management
- Current pesticides ineffective due to resistance
- Trade risk - current pesticides unsuitable where crop commodities will be exported
- IPM, environment or OH&S issues
- Loss of pesticides due to removal from market or chemical review restrictions
- Opportunity to extrapolate a use pattern when a new, effective pesticide is registered in another crop
- Alternate pesticide has overseas registration or minor use permit
- Market failure – insufficient return on investment for registrant.

With each of these options, sound, scientific argument is required to justify any new permit applications. Another option for the papaya industry is for manufacturers to register new pesticides uses in the crop.

3.3 Methods

The current version of the Papaya Strategic Agrichemical Review Process (SARP) is the first report for the industry and was conducted by desktop audit and included an online industry survey. The process included gathering, collating and confirming information. The steps in the process were:

Process of Review	Activity / Date
Industry survey	Preparation and circulation of online industry survey to update priority pests and identify priority control gaps. Survey released: 6 November 2023 Survey closed: 30 June 2024 Additional industry consultation was undertaken through personal communication to refine pest priorities.
SARP data updated via a desktop audit	Updated registrations and permits Updated MRL tables Updated available and potential pesticides against low, moderate and high priority pests, including an assessment of their suitability Included information on regulatory risks from MT20007
Captured industry input	Collated and analysed survey results Consolidated and incorporated industry needs and insights

[3] https://apvma.gov.au/node/10931

3.4 Results and discussions

3.4.1 Detail

Results and discussions are presented in the body of this document.

3.4.2 Appendices

Refer to additional information in the appendices:

Appendix 1. Products available for disease control in papaya
Appendix 2. Products available for control of insects and other pests in papaya
Appendix 3. Products available for weed control in papaya
Appendix 4. Plant Growth Regulators available in papaya
Appendix 5. Current permits for use in papaya
Appendix 6. Papaya Maximum Residue Limits (MRLs)
Appendix 7. Papaya regulatory risk assessment

4. Diseases, pests and weeds of papaya

Resistance management: To manage the risk of resistance development, integrated disease/pest/weed management (IDM/IPM/IWM) strategies should be adopted. The general principle is to integrate diverse chemical and non-chemical strategies; maximise efficacy; not rely on singular tools and rotate between different modes of action. It is always essential to follow all the label instructions. Specific resistance management strategies may apply. These can be found, along with other useful information, on the CropLife Australia website[4].

Information on regulatory risk derived from project MT20007 (Chapter 4) - Regulatory support and coordination (Appendix 7) has been incorporated. Some of the suggested options have no overseas MRLs (see Appendix 6). If treated fruit is to be exported nil residues at harvest would be needed for these options. While care has been taken to ensure the accuracy of the information provided in this document the APVMA registered label and where relevant the APVMA approved permit must always be followed.

[4] https://www.croplife.org.au/resources/programs/resistance-management/

4.1 Diseases of Papaya

4.1.1 Disease priorities

Disease	Priority
Phytophthora Root Rot (*Phytophthora* spp.)	H
Phytophthora Fruit Disease (*Phytophthora* spp.)	H
Black Spot (*Asperisporium caricae*)	H
Brown Spot (*Corynespora cassiicola*)	H
Anthracnose (*Colletotrichum gloeosporioides*)	H
Fusarium Fruit Rot (*Fusarium* spp.)	M
Cercospora Black Spot (*Cercospora papaya*)	M
Stem-End Rot (*Lasiodiplodia theobromae*, *Phomopsis caricae-papayae*, *Mycosphaerella* spp. & *Phytophthora palmivora*)	M
Damping Off (*Pythium* spp.)	M
Papaya Sticky Disease (P MeV)	M
Alternaria Fruit Spot (*Alternaria solani*)	L
Guignardia Spot (*Guignardia* spp.)	L
Rhizopus Soft Rot (*Rhizopus stolonifer*)	L
Penicillium Rot (*Penicillium digitatum*)	L
Powdery Mildew (*Sphaerotheca humuli*)	L
Rhizoctonia (*Rhizoctonia* spp.)	L

Phytophthora Root Rot, Phytophthora Fruit Disease, Black Spot, Brown Spot and Anthracnose were identified as high priority diseases of papaya. It is recommended that an Integrated Disease Management Strategy is implemented, including a range of cultural practices to support fungicides, and potentially reduce the reliance on fungicides for disease control.

Cultural controls include:

- Biosecurity measures to prevent importing infections from other farms.
- Promoting good drainage and avoid waterlogging through irrigation.
- Farm hygiene – remove dead plant material that could contain disease inoculum.
- Avoid crop stress through good nutrition and water management.

Growers have raised concerns about the limited availability of protective chemistry for managing Brown Spot and Anthracnose. Phytophthora is a particular concern for coastal growers, and they are requesting more work be done to address this problem.

In controlling fungal and bacterial diseases, the industry should be mindful of resistance management. In addition to cultural controls, it is important to include a range of fungicide groups in a foliar spray program, including the use of protectant fungicides. Fungicide programs should be planned at the start of the season to ensure that effective disease control is achieved in conjunction with appropriate product rotation.

CropLife Australia have resistance management strategies[5] available which provide useful guidance for growers when preparing their disease control programs.

[5] https://www.croplife.org.au/resources/programs/resistance-management/

4.1.2 Available and potential products for priority diseases

TABLE KEY: Note that blank fields in the table indicate no information has been provided.

Availability		Regulatory risk (refer to Appendix 7)	
A	Available via either registration or permit approval	R1	Short-term: Critical concern over retaining access
P	Potential - a possible candidate to pursue for registration or permit	R2	Medium-term: Maintaining access of significant concern
P-A	Potential, already approved in the crop for another use	R3	Long-term: Potential issues associated with use - Monitoring required

Withholding Period (WHP) – Number of days from last treatment to harvest (H) or Grazing (G)			
Harvest	H	Not Required when used as directed	NR
Grazing	G	No Grazing Permitted	NG

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Phytophthora Root Rot (*Phytophthora* spp.) **Priority: High**							
Rated as a high priority in QLD & WA. Phytophthora is a widespread soil-borne pathogen that thrives in poorly drained soil and warm temperatures. Severe infections can lead to severe necrosis of roots and subsequent yellowing and wilting of above ground plant parts. Trees can eventually die. Management includes site selection to ensure good drainage, improving soil organic matter, careful irrigation management and fungicide treatments.							
Metalaxyl-M (Ridomil Gold 25G) PER14490	4	Protectant	NR	A	QLD	Permitted in pawpaw (papaya) for control of **Phytophthora Root Rot** (*Phytophthora palmivora*) and Pythium (*Pythium* spp.) Apply in a 40cm band along the centre of the plant row for newly planted trees or ratoons. Water in after application to carry fungicide into root zone. Maximum of 1 application per crop.	-
Phosphorous Acid PER14490	P07	Protectant & Curative	NR	A	QLD	Permitted in pawpaw (papaya) for control of **Phytophthora Root Rot** (*Phytophthora palmivora*) and Pythium (*Pythium* spp.) Apply either through fertigation to newly established or damaged established trees, or as a foliar application using a 14 day retreatment interval. Maximum number of treatments per season not specified.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Bacillus amyloliquefaciens Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	BM02	Biological	NR	P-A	ALL	Registered in tropical fruit (excluding banana) for control of Anthracnose (*Colletotrichum* spp.) and suppression of Stem End Rot. Available in fruit crops for application to soil to improve bioavailability of soil resources to horticultural crops. Registered for suppression of soil-borne diseases such as Black Scurf in potatoes and Pineapple Disease in sugarcane.	-
Streptomyces lydicus (Actinovate) Novozymes BioAg	BM02	Biological	NR	P-A	ALL	Registered in all crops as a biological soil amendment to stimulate soil organisms to make nutrients more available for plant growth. Registered for control of **Phytophthora** in strawberries and tomato.	-
Mandipropamid (Revus) Syngenta	40	Curative / Protectant		P		Registered for control of Downy Mildew in grapes, lettuce, leafy vegetables and oilseed poppies. US registration for control of **Phytophthora** in various crops, including as a foliar application for protection of citrus from Phytophthora Root Rot.	-
Oxathiopiprolin (Zorvec Enicade) Corteva	49	Protectant & Curative		P		Registered for control of Downy Mildew in bulb vegetables, brassicas, cucurbits, leafy vegetables and poppies. Permitted for control of **Phytophthora Root Rot** in raspberries and blackberries. US registration for control of **Phytophthora** Canker and Brown Rot in citrus.	-
Phytophthora Fruit Disease (*Phytophthora* spp.) **Priority: High**							
Rated as a high priority in QLD and as a moderate priority in WA. Phytophthora Fruit Disease will attack immature and mature green fruit, causing mycelial growth which impacts on marketability of produce. Infected fruit falling to the ground are considered a major source of the disease. In addition to controls for Phytophthora Root Rot, control can be assisted through the use of foliar fungicides and infected fruit should be removed from the orchard.							
Copper Hydroxide PER14417	M1	Protectant	1	A	ALL	Permitted in papaya for control of **Papaya Fruit Rot** (*Phytophthora palmivora*). Apply as a foliar spray at first sign of infection or as a preventative treatment. Use a retreatment interval of 10-14 days. Maximum number of applications per season not specified.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Bacillus amyloliquefaciens Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	BM02	Biological	NR	P-A	ALL	Registered in tropical fruit (excluding banana) for control of Anthracnose (*Colletotrichum* spp.) and suppression of Stem End Rot. Available in fruit crops for application to soil to improve bioavailability of soil resources to horticultural crops. Registered for suppression of soil-borne diseases such as Black Scurf in potatoes and Pineapple Disease in sugarcane.	-
Metalaxyl-M (Ridomil Gold 25G) PER14490	4	Protectant	NR	P-A	QLD	Permitted in pawpaw (papaya) for control of Phytophthora Root Rot (*Phytophthora palmivora*) and Pythium (*Pythium* spp.)	-
Phosphorous Acid PER14490	P07	Protectant & Curative	NR	P-A	QLD	Permitted in pawpaw (papaya) for control of Phytophthora Root Rot (*Phytophthora palmivora*) and Pythium (*Pythium* spp.)	-
Streptomyces lydicus (Actinovate) Novozymes BioAg	BM02	Biological	NR	P-A	ALL	Registered in all crops as a biological soil amendment to stimulate soil organisms to make nutrients more available for plant growth. Registered for control of **Phytophthora** in strawberries and tomato.	-
Mandipropamid (Revus) Syngenta	40	Curative / Protectant		P		Registered for control of Downy Mildew in grapes, lettuce, leafy vegetables and oilseed poppies. US registration for control of **Phytophthora** in various crops, including as a foliar application for protection of citrus from Phytophthora Root Rot.	-
Oxathiopiprolin (Zorvec Enicade) Corteva	49	Protectant & Curative		P		Registered for control of Downy Mildew in bulb vegetables, brassicas, cucurbits, leafy vegetables and poppies. Permitted for control of **Phytophthora Root Rot** in raspberries and blackberries. US registration for control of **Phytophthora** Canker and Brown Rot in citrus.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Black Spot (*Asperisporium caricae*) **Priority: High**							
Rated as a high priority in QLD and as a low priority in WA. Black Spot causes lesions on leaves and fruit of papaya, and loss of leaf can also cause fruit blemishes due to sunburn. Marketability of affected fruit is reduced. A planned fungicide program is recommended to manage this disease, as well as managing trees to improve airflow and reduce leaf wetness.							
Chlorothalonil PER12592	M5	Protectant	3	A	ALL (excl. VIC)	Permitted in papaya for control of **Black Spot** (*Asperisporium caricae*) and Brown Spot (*Corynespora cassicola*). Apply as a foliar spray when conditions favour disease. Use a retreatment interval of 10-14 days. Maximum number of applications per season not specified.	R3
Difenoconazole PER12592	3	Protectant & Curative	3	A	ALL (excl. VIC)	Permitted in papaya for control of **Black Spot** (*Asperisporium caricae*). Apply as a foliar spray, commencing during the cooler months. When disease potential is high, apply 2 consecutive sprays at 14-21 day interval before applying further treatments of a protectant fungicide from a different activity group. Maximum of 6 applications per season.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative	3 NG	A	ALL	Registered in papaya for control of **Black Spot** (*Asperisporium caricae*) and Brown Spot (*Corynespora cassiicola*). Apply as a foliar spray when crop is susceptible to disease infection. Use a retreatment interval of 14-21 days. Maximum of 3 applications per season.	-
Mancozeb	M3	Protectant	1 NG	A	ALL	Registered in pawpaw (papaya) for control of **Black Spot**. Apply as a foliar spray when conditions are conductive to disease. Use a retreatment interval of 10-14 days. Maximum number of applications per season not specified.	R2
Tebuconazole	3	Protectant & Curative	3	A	ALL	Registered in pawpaw for control of **Black Spot**. Apply as a foliar spray when conditions are conductive to disease. Use a retreatment interval of 14 days. Maximum of 6 applications per season.	R3
Bacillus amyloliquefaciens strain QST713 (Serenade Opti) Bayer	BM02	Biological	NR	P-A	ALL	Registered in tropical fruit (excluding banana) for control of Anthracnose (*Colletotrichum* spp.) and suppression of Stem End Rot.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Aureobasidium pullulans Strain DSM 14940 & DSM 14941 (Botector) Nufarm	-	Biological / Protectant	NR	P		Registered for control of various diseases in grapes, berries and fruiting vegetables.	-
BLAD (Problad Plus)	BM01	Biological	NR	P		Registered in stone fruit for suppression of Brown Rot.	-
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered for control of Powdery Mildew in grapes, control of Black Spot and Powdery Mildew and suppression of Alternaria in apples, control of Blossom Blight and suppression of Leaf Rust, Shot Hole and Hull Rot in almonds, control of Husk Spot in macadamias, control of Powdery Mildew and Gummy Stem Blight in cucurbits, and control of Powdery Mildew and Target Spot in fruiting vegetables.	-
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant / Curative		P		Registered for control of various diseases in grapes, berries, leafy vegetables, lettuce and potato.	R3
Brown Spot (*Corynespora cassiicola*) **Priority: High**							
Rated as a moderate priority in QLD and as a low priority in WA. Additional industry consultation nominated Brown Spot as a high priority for the industry. It is a serious disease of papaya that causes lesions on leaves and fruit. This disease causes significant problems during wet, humid periods on the Wet Tropic coast. Fungicide programs can provide unreliable control in these conditions with outbreaks ranging from minor cases causing leaf drop to severe cases resulting in fruit marking, downgrades, and discard. The removal of severely affected older leaves prior to application of fungicides has been shown to greatly enhance disease control.							
Chlorothalonil PER12592	M5	Protectant	3	A	ALL (excl. VIC)	Permitted in papaya for control of Black Spot (*Asperisporium caricae*) and **Brown Spot** (*Corynespora cassicola*). Apply as a foliar spray when conditions favour disease. Use a retreatment interval of 10-14 days. Maximum number of applications per season not specified.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative	3 NG	A	ALL	Registered in papaya for control of Black Spot (*Asperisporium caricae*) and **Brown Spot** (*Corynespora cassiicola*). Apply as a foliar spray when crop is susceptible to disease infection. Use a retreatment interval of 14-21 days. Maximum of 3 applications per season.	-
Bacillus amyloliquefaciens strain QST713 (Serenade Opti) Bayer	BM02	Biological	NR	P-A	ALL	Registered in tropical fruit (excluding banana) for control of Anthracnose (*Colletotrichum* spp.) and suppression of Stem End Rot.	-
Aureobasidium pullulans Strain DSM 14940 & DSM 14941 (Botector) Nufarm	-	Biological / Protectant	NR	P		Registered for control of Botrytis and other diseases in grapes, berries and fruiting vegetables.	-
BLAD (Problad Plus)	BM 01	Biological	NR	P		Registered in stone fruit for suppression of Brown Rot.	-
Florylpicoxamid (Verpixo Adavelt) Corteva	21	Protectant		P		Registered for control of Powdery Mildew in cucurbits, Powdery Mildew and Target Spot in capsicum, chilli, eggplant, okra and tomato, Sclerotinia Rot in lettuce,and Grey Mould and Powdery Mildew in strawberry.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of various diseases in various fruit and vegetable crops, tree nuts and pyrethrum. Pending registration in Tropical & Subtropical Fruit (Inedible Peel).	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Anthracnose (*Colletotrichum gloeosporioides*) **Priority: High**							
Rated as a moderate priority in QLD and as a low priority in WA. Additional industry consultation nominated Anthracnose as a high priority for the industry. Particularly problematic in wet, humid conditions and older plantings, Anthracnose can be one of the most significant disease challenges after Phytophthora. Poor management can lead to fruit breakdown at the market floor, with entire consignments sometimes rejected despite all reasonable management options being followed. Anthracnose should be managed using an integrated approach including cultural methods and fungicide applications. Cultural practices include minimising periods of leaf wetness and destruction of crop residues.							
Bacillus amyloliquefaciens strain QST713 (Serenade Opti) Bayer	BM02	Biological	NR	A	ALL	Registered in tropical fruit (excluding banana) for control of **Anthracnose** (*Colletotrichum* spp.) and suppression of Stem End Rot. Begin applications as a foliar spray when crop reaches susceptible stage for Anthracnose infection. Use a retreatment interval of 7-21 days. Maximum number of applications per season not specified.	-
Bacillus amyloliquefaciens strain QST713 (Serenade Prime) Bayer	BM02	Biological	NR	A	ALL	Registered in tropical fruit (excluding banana) for control of **Anthracnose** (*Colletotrichum* spp.) and suppression of Stem End Rot. Begin applications as a foliar spray when crop reaches susceptible stage for Anthracnose infection. Use a retreatment interval of 7-21 days. Maximum number of applications per season not specified.	-
Fludioxonil (Scholar) PER89170	12	Protectant	NR	A	NSW, NT, QLD & WA	Permitted in papaya for post-harvest control of **Anthracnose** (*Colletotrichum gloeosporioides*) and Stem End Rot (Botryospaeriaceae, including *Lasiodiplodia* & *Dothiorella*). Apply as a post-harvest dip or spray, ensuring fruit is in contact with dip or spray for 30-60 seconds. Maximum of 1 application per crop.	R3
Prochloraz	3	Protectant & Curative	NR	A	QLD, NSW, WA & NT	Registered in papaya for post-harvest control of **Anthracnose** (*Colletotrichum* spp.) and Stem End Rot. Apply as a post-harvest spray for 1 minute.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative	3 NG	P-A	ALL	Registered in papaya for control of Black Spot (*Asperisporium caricae*) and Brown Spot (*Corynespora cassiicola*). Registered for control of **Anthracnose** in avocados, mangoes and other tropical & sub-tropical fruits, inedible peel (excluding bananas, papaya, passionfruit, pineapples) and Japanese persimmons.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Aureobasidium pullulans Strain DSM 14940 & DSM 14941 (Botector) Nufarm	-	Biological / Protectant	NR	P		Registered for control of Botrytis and other diseases in grapes, berries and fruiting vegetables, including the suppression of **Anthracnose Fruit Rot** in berries.	-
Benzovindiflupyr + Propiconazole (Elatus) Syngenta	7+3	Protectant & Curative		P		Registered for control of various disease in wheat and barley. US registration for **Anthracnose** in sweet corn.	R3
BLAD (Problad Plus)	BM 01	Biological	NR	P		Registered in stone fruit for suppression of Brown Rot. US registration for control of **Anthracnose** in grapes and strawberries.	**-**
Dimethomorph (Acrobat)	40	Protectant		P		Registered for control of **Anthracnose** in cucurbits and lettuce.	-
Fludioxonil + Azoxystrobin (Graduate A+) Syngenta	12+11	Protectant / Post-harvest treatment		P		Registered for post-harvest control of **Anthracnose** in avocado.	R3
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of various diseases in various fruit and vegetable crops, tree nuts and pyrethrum. Pending registration in Tropical & Subtropical Fruit (Inedible Peel). US registration for control of **Anthracnose** in almonds, cucurbits and tree nuts.	R3
Fluxapyroxad + Pyraclostrobin (Merivon) BASF	7+11	Protectant & Curative		P		Registered in almonds, cherries and macadamia for control of various leaf diseases. Registered for control of **Anthracnose** in almonds. US registration for control of **Anthracnose** in strawberries.	-
Isofetamid (Kenja) ISK / AgNova	7	Protectant & Curative		P		Registered in strawberries for control of Botrytis Grey Mould. US registration for control of Grey Mould, Powdery Mildew and **Anthracnose** in low-growing berries.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered for control of Powdery Mildew in grapes, control of Black Spot and Powdery Mildew and suppression of Alternaria in apples, control of Blossom Blight and suppression of Leaf Rust, Shot Hole and Hull Rot in almonds, control of Husk Spot in macadamias, control of Powdery Mildew and Gummy Stem Blight in cucurbits, and control of Powdery Mildew and Target Spot in fruiting vegetables. US registration for control of **Anthracnose** in fruiting vegetables and tree nuts.	-
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant / Curative		P		Registered for control of various diseases in grapes, berries, leafy vegetables, lettuce and potato. US registration for control of **Anthracnose** in grape and small fruit vine climbing (except fuzzy kiwifruit), lemon & lime, low-growing berries, specific tree nuts, almonds and bushberries.	R3
Fusarium Fruit Rot (*Fusarium* spp.) **Cercospora Black Spot** (*Cercospora papaya*) **Stem-End Rot** (*Lasiodiplodia theobromae*, *Phomopsis caricae-papayae*, *Mycosphaerella* spp. & *Phytophthora palmivora*) **Priority: Moderate**							
Rated as a moderate priority in QLD and as a low priority in WA. Fusarium Fruit Rot, Cercospora Black Spot and Stem-End Rot affect the fruit when ripe and management is dependent on the use of post-harvest treatments. Treatments used for managing other post-harvest fruit rots such as Anthracnose will also control these diseases and maintain fruit quality and marketability.							
Bacillus amyloliquefaciens strain QST713 (Serenade Opti) Bayer	BM02	Biological	NR	A	ALL	Registered in tropical fruit (excluding banana) for control of Anthracnose (*Colletotrichum* spp.) and suppression of **Stem End Rot**. Begin applications as a foliar spray when crop reaches susceptible stage for disease infection. Use a retreatment interval of 7-21 days. Maximum number of applications per season not specified.	-
Bacillus amyloliquefaciens strain QST713 (Serenade Prime) Bayer	BM02	Biological	NR	A	ALL	Registered in tropical fruit (excluding banana) for control of Anthracnose (*Colletotrichum* spp.) and suppression of **Stem End Rot**. Begin applications as a foliar spray when crop reaches susceptible stage for Anthracnose infection. Use a retreatment interval of 7-21 days. Maximum number of applications per season not specified.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Bromo Chloro Dimethyl Hydatoin (BCDMH)	-	Sanitiser / Post-Harvest Treatment	NR	A	ALL	Registered in fruit & vegetables for control of bacteria and fungi by post-harvest surface sterilisation of fruit using spray or dip. Minimum contact 60 seconds.	-
Chlorine	-	Sanitiser / Post-Harvest Treatment	NR	A	ALL	Registered in fruit & vegetables for control of bacteria and fungi as a post-harvest spray. Minimum contact 30 seconds.	-
Didecyl Dimethyl Ammonium Chloride	-	Sanitiser	NR	A	ALL	Registered in tropical and sub-tropical fruit (inedible peel) for control of post-harvest decay and diseases. Dip fruit for 3 minutes.	-
Fludioxonil (Scholar) PER89170	12	Protectant	NR	A	NSW, NT, QLD & WA	Permitted in papaya for post-harvest control of Anthracnose (*Colletotrichum gloeosporioides*) and **Stem End Rot** (Botryospaeriaceae, including *Lasiodiplodia* & *Dothiorella*). Apply as a post-harvest dip or spray, ensuring fruit is in contact with dip or spray for 30-60 seconds. Maximum of 1 application per crop.	R3
Iodine	-	Sanitiser	NR	A	ALL	Registered in Tropical & Sub-Tropical Fruit (Inedible Peel) for sanitation of **post-harvest decay and diseases**. Dip fruit for a minimum of 1 minute.	-
Prochloraz	3	Protectant & Curative	NR	A	QLD, NSW, WA & NT	Registered in papaya for post-harvest control of Anthracnose (*Colletotrichum* spp.) and **Stem End Rot**. Apply as a post-harvest spray for 1 minute.	R3
Fludioxonil + Azoxystrobin (Graduate A+) Syngenta	12+11	Protectant / Post-harvest treatment		P		Registered for control of side rot caused by Anthracnose and Botryosphaeriaceous fungi in avocado.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Damping Off (*Pythium* spp.) **Priority: Moderate**							
Rated as a moderate priority in QLD and as a high priority in WA. Damping Off affects seedling papaya plants with infections often occurring in containerised seedlings that are being raised in warm, wet autumn conditions. Maintenance of good hygiene in seedling raising facilities will assist along with the use of fungicides to protect the new plantings, particularly when the crop is being established in the cooler part of the year.							
Chloropicrin + 1,3-Dichloropropene (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in tree crops for control of plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	-
Metalaxyl-M (Ridomil Gold 25G) PER14490	4	Protectant	NR	A	QLD	Permitted in pawpaw (papaya) for control of Phytophthora Root Rot (*Phytophthora palmivora*) and **Pythium** (*Pythium* spp.) Apply in a 40cm band along the centre of the plant row for newly planted trees or ratoons. Water in after application to carry fungicide into root zone. Maximum of 1 application per crop.	-
Phosphorous Acid PER14490	P07	Protectant & Curative	NR	A	QLD	Permitted in pawpaw (papaya) for control of Phytophthora Root Rot (*Phytophthora palmivora*) and **Pythium** (*Pythium* spp.) Apply either through fertigation to newly established or damaged established trees, or as a foliar application using a 14 day retreatment interval. Maximum number of treatments per season not specified.	-
Propamocarb PER91912	28	Protectant	NR	A	NSW, QLD, NT & WA	Permitted in papaya for control of **Damping Off** (*Pythium* spp.) Apply 1 application as a soil drench to 1-3 week old seedlings in nursery.	-
Bacillus amyloliquefaciens Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	BM02	Biological	NR	P-A	ALL	Registered in tropical & sub-tropical fruit, inedible peel (excluding banana) for control of Anthracnose and Stem End Rot. Registered for control of soil-borne diseases in potatoes and sugarcane.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Streptomyces lydicus (Actinovate) Novozymes BioAg	BM02	Biological	NR	P-A	ALL	Registered in all crops as a biological soil amendment to stimulate soil organisms to make nutrients more available for plant growth.	-
Acibenzolar-S-Methyl (Actigard Plant Activator) Syngenta	P01	Protectant		P		Registered in tomatoes for the suppression of Bacterial Speck, Bacterial Spot, Bacterial Canker and Powdery Mildew. US registration (Bion) for control of **Damping Off** caused by *Rhizoctonia solani*, *Pythium* and *Fusarium* sp. in cotton.	-
Papaya Sticky Disease (P MeV) **Priority: Moderate**							
Rated as a moderate priority in QLD and as a low priority in WA. Papaya Sticky Disease is a viral infection that has been detected in QLD and NT but is not currently found in WA. A watery translucent discharge from green fruit is the first symptom of disease, with infected fruit unmarketable due to the cosmetic effect and compromised flavour. The disease can spread through pruning and fruit picking, as well as in infected tissue culture. Leafhoppers and whitefly may also play a role as disease vectors.							
No control options available							
Alternaria Fruit Spot (*Alternaria solani*) **Guignardia Spot** (*Guignardia* spp.) **Rhizopus Soft Rot** (*Rhizopus stolonifer*) **Penicillium Rot** (*Penicillium digitatum*) **Priority: Low**							
Rated as a low priority in QLD and WA. Alternaria Fruit Spot, Guignardia Spot, Rhizopus Soft Rot and Penicillium Rot affect the fruit when ripe and management is dependent on the use of post-harvest treatments. Treatments used for managing other post-harvest fruit rots such as Anthracnose will also control these diseases and maintain fruit quality and marketability.							
Bromo Chloro Dimethyl Hydatoin (BCDMH)	-	Sanitiser / Post-Harvest Treatment	NR	A	ALL	Registered in fruit & vegetables for control of bacteria and fungi by post-harvest surface sterilisation of fruit using spray or dip. Minimum contact 60 seconds.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Chlorine	-	Sanitiser / Post-Harvest Treatment	NR	A	ALL	Registered in fruit & vegetables for control of bacteria and fungi as a post-harvest spray. Minimum contact 30 seconds.	-
Didecyl Dimethyl Ammonium Chloride	-	Sanitiser	NR	A	ALL	Registered in tropical and sub-tropical fruit (inedible peel) for control of post-harvest decay and diseases. Dip fruit for 3 minutes.	-
Iodine	-	Sanitiser	NR	A	ALL	Registered in Tropical & Sub-Tropical Fruit (Inedible Peel) for sanitation of **post-harvest decay and diseases**. Dip fruit for a minimum of 1 minute.	-
Fludioxonil (Scholar) PER89170	12	Protectant	NR	P-A	NSW, NT, QLD & WA	Permitted in papaya for post-harvest control of Anthracnose (*Colletotrichum gloeosporioides*) and Stem End Rot (Botryospaeriaceae, including *Lasiodiplodia* & *Dothiorella*).	R3
Prochloraz	3	Protectant & Curative	NR	P-A	QLD, NSW, WA & NT	Registered in papaya for post-harvest control of Anthracnose (*Colletotrichum* spp.) and Stem End Rot.	R3
Fludioxonil + Azoxystrobin (Graduate A+) Syngenta	12+11	Protectant / Post-harvest treatment		P		Registered for control of side rot caused by Anthracnose and Botryosphaeriaceous fungi in avocado.	R3
Powdery Mildew (*Sphaerotheca humuli*) **Priority: Low**							
Rated as a low priority in QLD and WA. Powdery Mildew is a seasonal problem in papaya, occasionally occurring during autumn and spring when humidity and temperature conditions are ideal. Regular fungicide programs should provide incidental control of Powdery Mildew.							
Bupirimate (Nimrod)	8	Protectant & Curative	NR	A	ALL	Registered in non-bearing fruit trees for control of **Powdery Mildew**. Apply as a foliar spray when conditions favour disease development. Use a retreatment interval of 7-14 days. Maximum number of applications per season not specified.	-
Triadimenol	3	Protectant & Curative	7	A	QLD, NSW & WA	Registered in pawpaw for control of **Powdery Mildew**. Apply as a foliar spray when infection begins or when conditions favour the disease. Use a retreatment interval of 14 days. Maximum number of applications per season not specified.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Bacillus amyloliquefaciens strain QST713 (Serenade Opti) Bayer	BM02	Biological	NR	P-A	ALL	Registered in tropical fruit (excluding banana) for control of Anthracnose (*Colletotrichum* spp.) and suppression of Stem End Rot. Permitted for control of **Powdery Mildew** in eggplant.	-
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative	3 NG	P-A	ALL	Registered in papaya for control of Black Spot (*Asperisporium caricae*) and Brown Spot (*Corynespora cassiicola*). Registered for control of **Powdery Mildew** in apples, pears, strawberries and green beans.	-
Streptomyces lydicus (Actinovate) Novozymes BioAg	BM02	Biological	NR	P-A	ALL	Registered in all crops as a biological soil amendment to stimulate soil organisms to make nutrients more available for plant growth. Registered for control of **Powdery Mildew** in strawberries, carrots, cucurbits, fruiting vegetables and verbena.	-
Acibenzolar-S-Methyl (Actigard Plant Activator) Syngenta	P01	Protectant		P		US registration for suppression of **Powdery Mildew** in cucurbits.	-
Azoxystrobin (Amistar)	11	Protectant & Curative		P		Registered for control of **Powdery Mildew** in grapes, carrots, cucurbits, nursery stock and ornamentals.	-
BLAD (Problad)	BM01	Protectant		P		Registered control of **Powdery Mildew** in cucurbits.	-
Bacillius amyloliquefaciens (Serifel) BASF	BM02	Biological	NR	P		Registered in strawberries and berries (including blackberries, blueberries and raspberries) for control of Grey Mould (*Botrytis cinerea*). US registration for control of **Powdery Mildew** in artichoke, berries, brassica leafy vegetables, bulb vegetables, cucurbits, fruiting vegetables, grapes, hops, leafy vegetables, legume vegetables, pome fruit, stone fruit, sugar beet and tobacco.	-
Cyflufenamid (Flute) AgNova	U6	Protectant & Curative		P		Registered in cucurbits for control of **Powdery Mildew** in grapevines, cucurbits and strawberries.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Florylpicoxamid (Verpixo Adavelt) Corteva	21	Protectant		P		Registered for control of **Powdery Mildew** in cucurbits, capsicum, chilli, eggplant, okra, tomato and strawberry.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of **Powdery Mildew** in grapevines, capsicums, tomatoes and cucurbits.	R3
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of **Powdery Mildew** in grapes, fruiting vegetables and cucurbits.	-
Mandestrobin (Intuity) Sumitomo	11	Protectant & Curative		P		Registered for control of **Powdery Mildew** in cucurbits.	-
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered for control of **Powdery Mildew** in grapes, apples, cucurbits and fruiting vegetables.	-
Metrafenone (Vivando) BASF	50	Protectant		P		Registered for control of **Powdery Mildew** in cucurbits and grapevines.	-
Orange Oil (Prev-Am) Oro Agri	-	Protectant		P		Registered for control of **Powdery Mildew** in tomato, eggplant, cucurbits, raspberries and strawberries.	-
Penthiopyrad (Fontelis) Corteva	7	Protectant		P		Registered for control of **Powdery Mildew** in strawberry, pome fruit, cucurbits, fruiting vegetables, leafy vegetables and root & tuber vegetables.	-
Polyoxin D Zinc Salt (Intervene) Nufarm	19	Protectant	NR	P		Registered for control of **Powdery Mildew** in cucurbits, fruiting vegetables, herbs & spices, strawberries and ornamentals.	**-**

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Proquinazid (Talendo) Corteva	13	Protectant		P		Registered for control of **Powdery Mildew** in cucurbits, fruiting vegetables, grapes and pome fruit.	-
Pyraclostrobin + Fluxapyroxad (Merivon) BASF	11+7	Protectant & Curative		P		Registered for control of **Powdery Mildew** in fruiting vegetables, cucurbits and mango.	-
Pyriofenone (Kusabi) AgNova	50	Protectant		P		Registered for control of **Powdery Mildew** in cucurbits and grapevines.	-
Rhizoctonia (*Rhizoctonia* spp.) **Priority: Low**							
Rated as a low priority in QLD and WA. Rhizoctonia is a widespread, soilborne pathogen that can impact on establishment of young plants. Judicious use of irrigation and maintaining good soil drainage will assist with reducing the impact of Rhizoctonia. Fungicides used for protection of seedlings from Phytophthora and Pythium will also provide control of Rhizoctonia.							
Chloropicrin + 1,3-Dichloropropene (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in tree crops for control of plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	-
Bacillus amyloliquefaciens Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	BM02	Biological	NR	P-A	ALL	Registered in tropical & sub-tropical fruit, inedible peel (excluding banana) for control of Anthracnose and Stem End Rot. Registered for control of soil-borne diseases in potatoes and sugarcane.	-
Streptomyces lydicus (Actinovate) Novozymes BioAg	BM02	Biological	NR	P-A	ALL	Registered in all crops as a biological soil amendment to stimulate soil organisms to make nutrients more available for plant growth.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Acibenzolar-S-Methyl (Actigard Plant Activator) Syngenta	P01	Protectant		P		Registered in tomatoes for the suppression of Bacterial Speck, Bacterial Spot, Bacterial Canker and Powdery Mildew. US registration (Bion) for control of Damping Off caused by ***Rhizoctonia solani***, *Pythium* and *Fusarium* sp. in cotton.	-

4.2 Insect and other pests of Papaya

4.2.1 Insect and other pest priorities

Insects and Other Pests	Priority
Fruit Spotting Bug (*Amblypelta nitida*)	H
Banana Spotting Bug (*Amblypelta lutescens*)	H
Two Spotted Mite (*Tetranychus urticae*)	H
African Spider Mite (*Eutetranychus africanus*)	H
Papaya Mealy Bug (*Paracoccus marginatus*)	H
Oriental Scale (*Aionidiella orientalis*)	L
Queensland Fruit Fly (*Bactrocera tryoni*)	L
Cutworm (*Agrotis* spp.)	L

Papaya crops are impacted by a small number insect and other pests, with Fruit Spotting Bug, Banana Spotting Bug, Two Spotted Mite and Papaya Mealy Bug rated as high priority pests. It is important to take an Integrated Pest Management (IPM) Approach to pest control in papaya. A range of control measures should be used, including cultural controls, biological controls and insecticides. Beneficial insects such as predators, parasitoids and pollinators should be encouraged and can be introduced artificially if required. Insecticide choice should be made with regard to preserving the beneficial insects that play an important role in the crop.

The diverse range of insect and mite pests in papaya necessitates careful planning with resistance management. Growers should refer to resistance management strategies listed on the CropLife website[6] when planning their pest management programs.

[6] https://www.croplife.org.au/resources/programs/resistance-management/

4.2.2 Available and potential products for priority insects and other pests

TABLE KEY: Note that blank fields in the table indicate no information has been provided.

Availability		Regulatory risk (refer to Appendix 7)	
A	Available via either registration or permit approval	R1	Short-term: Critical concern over retaining access
P	Potential - a possible candidate to pursue for registration or permit	R2	Medium-term: Maintaining access of significant concern
P-A	Potential, already approved in the crop for another use	R3	Long-term: Potential issues associated with use - Monitoring required
Withholding Period (WHP) – Number of days from last treatment to harvest (H) or Grazing (G)			
Harvest	H	Not Required when used as directed	NR
Grazing	G	No Grazing Permitted	NG
IPM – indicative overall impact on beneficials (based on the Cotton Pest Management Guide 2019-20 and cotton use patterns)			
VL – Very low; L – Low; M – Moderate; H – High; VH – Very High; - not specified			

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Fruit Spotting Bug (*Amblypelta nitida*) **Banana Spotting Bug** (*Amblypelta lutescens*) **Priority: High**								
Fruit Spotting Bug is rated as a high priority in QLD and as a moderate priority in WA. Banana Spotting Bug is rated as a high priority in QLD and as a low priority in WA. These are serious pests which sting the fruit at all stages from fruit set until picking. Damage caused affects the marketability of fruit. An insecticide program is required to protect the developing fruit. It may be possible to identify and treat hot-spots in the orchard.								
Acetamiprid + Pyriproxyfen (Trivor) Adama PER89943	4A+7C	Contact & Ingestion	28 NG	A	ALL (excl. VIC)	Permitted in papaya for control of **Fruit Spotting Bugs** (*Amblypelta nitida*, *Amblypelta lutescens*). Apply as a foliar spray when pests are active in the crop. Use a minimum retreatment interval of 14 days. Maximum of 2 applications per season.	M Bee:H	R2
Beta-Cyfluthrin (Bulldock) PER13671	3A	Contact	3	A	NSW, QLD, NT & WA	Permitted in papaya / pawpaw for control of **Banana Spotting Bug** (*Amblypelta lutescens*) and **Fruit Spotting Bug** (*Amblypelta nitida*). Apply as a foliar spray during January to May when pests are present in sufficient numbers to cause economic damage. Use a minimum retreatment interval of 21 days. Maximum of 2 applications per season.	VH Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Flupyradifurone (Sivanto Prime) Bayer	4D	Ingestion & Contact	3	A	ALL	Registered in tropical & sub-tropical fruit, inedible peel (excluding bananas, pineapple) for control of **Banana Spotting Bug** (*Amblypelta lutescens*), **Fruit Spotting Bug** (*Amblypelta nitida*), Green Planthopper and Mango Planthopper.	L Bee:L	-
Sulfoxaflor (Transform) Corteva	4C	Ingestion & Contact	3	A	ALL	Registered in tropical and sub-tropical fruit, inedible peel for control of **Banana Spotting Bug** and **Fruit Spotting Bug**. Apply as a foliar spray as part of a season long program targeting pests when active in the crop. Use a minimum retreatment interval of 14 days. Maximum of 2 applications per season.	M Bee:H	-
Trichlorfon	1B	Contact	2	A	QLD, NSW & NT	Registered in pawpaw for control of **Fruit Spotting Bug**. Apply as a foliar spray when pest activity is evident. Use a retreatment interval of 14 days. Maximum number of treatments per season not specified.	H Bee:H	R2
					QLD & NT	Registered in pawpaw for control of **Banana Spotting Bug**. Apply as a foliar spray when pest activity is evident. Use a retreatment interval of 14 days. Maximum number of treatments per season not specified.		
Two Spotted Mite (*Tetranychus urticae*) **African Spider Mite** (*Eutetranychus africanus*) **Priority: High**								
Two-Spotted Mite was rated as a high priority in QLD and as a low priority in WA. African Spider Mite was nominated as a high priority for the industry through additional industry consultation. Widespread pest with a broad host range. Two-Spotted Mites feed on the underside of leaves, causing stippling and yellowing which can coalesce into larger dead patches. African Spider Mite has become a significant issue over the past five years, affecting both coastal and Tablelands farms. It is now nearly as problematic as the Two-Spotted Mite. Mite abundance is favoured by hot, dry weather and populations can be flared by the use of broad-spectrum chemistry which disrupts beneficial species. An integrated pest management strategy should be employed, including preservation of beneficials, suppression of dust and general farm hygiene measures.								
Abamectin	6	Ingestion	7 NG	A	ALL	Registered in papaya / pawpaw for control of **Two Spotted Mite** (*Tetranychus urticae*). Apply as a foliar spray when pest first appears. Maximum of 1 application per season.	M Bee:H	-
Bifenazate (Acramite)	20D	Contact & Ingestion	7 G:28	A	ALL	Registered in papaya for control of **Two-Spotted Mite** (*Tetranychus urticae*). Apply as a foliar spray as soon as mites appear. Maximum of 1 application per season.	L Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Etoxazole (Paramite) PER14098	10B	IGR / Contact	7 NG	A	WA, NT, QLD & NSW	Permitted in papaya for control of **Two Spotted Mite** (*Tetranychus urticae*). Apply as a foliar spray when mites first appear. Maximum of 1 application per season.	L Bee:VL	-
Fenbutatin Oxide (Torque) PER14097	12	Contact	7 NG	A	ALL (excl. VIC)	Permitted in papaya for control of **Two Spotted Mite** (*Tetranychus urticae*). Apply as a foliar spray when pest first appears. Use a minimum retreatment interval of 14 days. Maximum of 2 applications per season.	L Bee:L	R2
Potassium Salts of Fatty Acid (Natrasoap)	-	Contact	NR	A	ALL	Registered in fruit for control of Aphids, Thrips, Mealybug, **Two-Spotted Mite**, Spider Mite and Whitefly. Apply as a cover spray. Retreatment interval and maximum number of treatments not specified.	L Bee:L	-
Acequinocyl (Kanemite) UPL	20B	Contact & Ingestion		P		Registered for control of **Two-Spotted Mite** in pome fruit and stone fruit.	L Bee:L	-
Cyflumetofen (Danisaraba) BASF	25A	Contact		P		Registered for control of **Two Spotted Mite** (*Tetranychus urticae*) in pome fruit, almond, citrus, grapes, strawberries, fruiting vegetables and ornamentals.	L Bee:L	-
Cyantraniliprole + Diafenthiuron (Minecto Forte) Syngenta	28+12A	Ingestion		P		Registered for control of **Two-Spotted Mite** (*Tetranychus urticae*) in cucurbits and fruiting vegetables.	M Bee:VH	-
Hexythiazox (Calibre)	10A	IGR / Contact		P		Registered for control of **Two-Spotted Mite** in apples, pears, stone fruit, strawberries and ornamentals.	L Bee:L	-
Isocycloseram (Simodis) Syngenta	30	Ingestion		P		Registered for control of **Two-Spotted Mite** (*Tetranychus urticae*) in cucurbits and fruiting vegetables.	H Bee:VH	-
Magnesium Hydroxide (Magnera) UPL	-	Contact		P		Registered for suppression of **Two-Spotted Mite** in tomatoes and cucurbits.	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Orange Oil (Prev-Am) Oro Agri	-	Contact		P		Registered for control of **Two-Spotted Mite** (*Tetranychus urticae*) in tomato, eggplant, sugar snap peas, snow peas, raspberries, strawberries and cucurbits.	L Bee:L	-
Petroleum Oil	-	Contact		P		Registered for control of **Mites** in apples, pears, apricots, cherries, almonds, peaches, nectarines, plums, prunes, pecans and ornamentals.	L Bee:L	-
Propargite	12C	Contact		P		Registered for control of **Two-Spotted Mite** in stone fruit, apples, pears, strawberries, bananas, vegetables, hops and ornamentals.	M Bee:L	R3
Spiromesifen (Interrupt) Bayer	23	Ingestion		P		Registered for control of **Two Spotted Mite** in pome fruit and stone fruit.	M Bee:VL	-
Papaya Mealy Bug (*Paracoccus marginatus*) **Priority: High**								
Rated as a high priority in QLD and WA. Papaya Mealybug is an invasive pest that can spread rapidly. It forms large infestations on leaves, fruit and stems and has been detected in the Northern Territory and South East Queensland.								
Potassium Salts of Fatty Acid (Natrasoap)	-	Contact	NR	A	ALL	Registered in fruit for control of Aphids, Thrips, **Mealybug**, Two-Spotted Mite, Spider Mite and Whitefly. Apply as a cover spray. Retreatment interval and maximum number of treatments not specified.	L Bee:L	-
Sulfoxaflor (Transform) Corteva	4C	Ingestion & Contact	3	A	ALL	Registered in papaya for suppression of Scale (*Coccidae* spp.) and **Mealybugs** (*Planococcus* spp.) Apply as a foliar spray as part of a program targeting crawlers when they are exposed and before they are protected under the fruit calyces or established between touching fruit. Use a retreatment interval of 14-21 days. Maximum of 2 applications per season.	M Bee:H	-
Acetamiprid + Pyriproxyfen (Trivor) Adama PER89943	4A+7C	Contact & Ingestion	28 NG	P-A	ALL (excl. VIC)	Permitted in papaya for control of Fruit Spotting Bugs (*Amblypelta nitida*, *Amblypelta lutescens*). Registered for control of **Mealybugs** in citrus, grapevines and macadamias.	M Bee:H	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Buprofezin (Applaud)	16	Ingestion		P		Registered for control of **Mealybugs** in citrus, custard apples, grapes, pears and persimmons.	L Bee:L	-
Spirotetramat (Movento) Bayer	23	Ingestion		P		Registered for control of **Mealybugs** in citrus, grapes, mangoes, passionfruit, pineapple, pome fruit, stone fruit, cotton and peanuts.	M Bee:L	-
Oriental Scale (*Aionidiella orientalis*) **Priority: Low**								
Rated as a low priority in additional industry consultation. Oriental Scale is a minor and infrequent pest. The parasitic wasp *Compariella lemniscata* provides effective biological control of this pest. Scales suck sap and heavy scale infestations on papaya trunks cause tissue damage allowing fungal infection. Infested trees become very unthrifty and may snap off in wind or die. Both the skin and fruit of infested fruit fail to ripen in the area surrounding the individual scales so that the ripe fruit has green spots and is inedible.								
Sulfoxaflor (Transform) Corteva	4C	Ingestion & Contact	3	A	ALL	Registered in papaya for suppression of **Scale** (*Coccidae* spp.) and Mealybugs (*Planococcus* spp.) Apply as a foliar spray as part of a program targeting crawlers when they are exposed and before they are protected under the fruit calyces or established between touching fruit. Use a retreatment interval of 14-21 days. Maximum of 2 applications per season.	M Bee:H	-
Acetamiprid + Pyriproxyfen (Trivor) Adama PER89943	4A+7C	Contact & Ingestion	28 NG	P-A	ALL (excl. VIC)	Permitted in papaya for control of Fruit Spotting Bugs (*Amblypelta nitida*, *Amblypelta lutescens*). Registered for control of various species of Scale in avocados, citrus, grapevines, macadamias and mangoes.	M Bee:H	R2
Flupyradifurone (Sivanto Prime) Bayer	4D	Contact & Ingestion	3	P-A	ALL	Registered in tropical & sub-tropical fruit, inedible peel (excluding bananas, pineapples) for control of Banana Spotting Bug (*Amblypelta lutescens*), Fruit Spotting Bug (*Amblypelta nitida*), Green Planthopper and Mango Planthopper. Registered for suppression of Scirtothrips in macadamias. US registration for control of **Scale Insects** in citrus, pome fruit and stone fruit.	L Bee:L	-
Buprofezin (Applaud)	16	Ingestion		P		Registered for control of **Scale** in citrus, custard apples, grapes, mangoes, passionfruit and persimmons.	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Fenoxycarb (Insegar) Syngenta	7B	Contact & Ingestion		P		Registered for control of **Scale** in apples, pears and olives.	M Bee:L	-
Spirotetramat (Movento) Bayer	23	Ingestion		P		Registered for control of various Scale insects in blueberries, citrus, grapes, mangoes, passionfruit, pome fruit and stone fruit.	M Bee:L	-
Queensland Fruit Fly (*Bactrocera tryoni*) **Priority: Low**								
Rated as a low priority in QLD and WA. Queensland Fruit Fly frequent papaya crops, but they cause limited economic damage in crop. Post-harvest treatments for Fruit Fly are required as a biosecurity measure for interstate and overseas exports.								
Dimethoate PER13859	1B	Contact	NR	A	ALL	Permitted in non-bearing fruit fly host crops for control of **Fruit Fly**. Apply as a foliar and/or ground cover spray to both fallen and retained fruit after final harvest. Do not use more than 2 applications per season.	H Bee:H	R3
Maldison	1B	Bait / Contact	3	A	ALL	Registered in fruit trees as a bait for control of **Fruit Fly**. Apply as a coarse foliar, spot or strip spray throughout the orchard or in fruit fly hot spots. Do not apply directly to fruit. Use a retreatment interval of 7 days. Maximum number of applications per season not specified.	H Bee:H	R3
Spinosad (Naturalure) Corteva	5	Bait / Ingestion	NR	A	ALL	Registered in tree crops for control of Fruit Flies including **Queensland Fruit Fly** and Mediterranean Fruit Fly. Apply as either a band or a spot spray to the lower canopy of fruiting plants. Begin applications as soon as monitoring traps indicate flies are present and fruit is at a susceptible stage. Repeat applications every 7 days, re-applying sooner if rain washes off the deposit. Avoid spraying the fruit as phytotoxicity may occur.	L Bee:H	-
Trichlorfon PER12450	1B	Contact	7 G:7	A	ALL (excl. VIC & TAS)	Permitted in papaya for control of **Queensland Fruit Fly** and **Mediterranean Fruit Fly**. Apply as a cover spray. Repeat at half concentration every 7-10 days. Apply a maximum of 4 applications per season.	H Bee:H	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Abamectin	6	Ingestion	7 NG	P-A	ALL	Registered in papaya / pawpaw for control of Two Spotted Mite (*Tetranychus urticae*). Registered for control of **Queensland Fruit Fly** in citrus, blueberries, blackberries and raspberries.	M Bee:H	-
Acetamiprid + Pyriproxyfen (Trivor) Adama PER89943	4A+7C	Contact & Ingestion	28 NG	P-A	ALL (excl. VIC)	Permitted in papaya for control of Fruit Spotting Bugs (*Amblypelta nitida*, *Amblypelta lutescens*). Registered for control of **Fruit Fly** in avocados, citrus and mangoes.	M Bee:H	R2
Cutworm (*Agrotis* spp.) **Priority: Low**								
Rated as a low priority in QLD and WA. Cutworms are a soil borne pest. The larvae are most active at night, when they will chew off seedlings at the base. They are most damaging when caterpillars transfer from summer and autumn weeds onto newly emerged seedlings. Natural predators and early control of summer and autumn weeds will help reduce larval survival prior to crop emergence. If required, cutworms can be controlled with insecticides; spot spraying may provide adequate control.								
Carbaryl	1A	Contact		P		Registered for control of **Cutworms** in grapes, beetroot, cucurbits, rosella, potatoes, turnips, cereals, pastures and ornamentals.	H Bee:H	R3
Clothianidin + Imidacloprid (Poncho Plus) BASF	4A	Protectant / Seed Treatment		P		Registered for control of **Cutworms** as a seed treatment in sweet corn, sunflower, canola & forage brassica.	M Bee:VH	R2

4.3 Weeds of Papaya

4.3.1 Weed priorities

Weeds	Priority
Nutgrass (*Cyperus rotundus*)	H
Flaxleaf Fleabane (*Conyza bonariensis*)	H
Mexican Clover (*Richardia brasiliensis*)	H
Blackberry Nightshade (*Solanum nigrum*)	H
Silverleaf Nightshade (*Solanum elaeagnifolium*)	H
Bellvine (*Ipomoea plebeia*)	H
Barnyard Grass (*Echinochloa colona*)	M
Crowsfoot Grass (*Dactyloctenium aegyptium*)	M
Couch Grass (*Cynodon dactylon*)	M
Caltrop (*Tribulus terrestris*)	L
Slender Celery (*Apium leptophyllum*)	L
Marshmallow (*Malva parviflora*)	L
Johnson Grass (*Sorghum halepense*)	L
Shepherd's Purse (*Capsella bursapastoris*)	L

Weed priorities can vary substantially between regions, and weed management generally is guided more by cultural methods than by specific problem weed species. An integrated weed management program incorporating mulch and inter-row grass cover should be used to reduce the need for herbicides in plantations. Our industry consultation identified Nutgrass, Flaxleaf Fleabane, Mexican Clover, Blackberry Nightshade, Silverleaf Nightshade and Bellvine as high priorities. These are invasive species which are difficult to kill and must be managed using a sustained management program incorporating multiple control measures.

Weed management poses significant challenges for papaya growers, particularly during the early stages after transplanting when weeds can quickly outcompete young plants. Papaya seedlings are highly sensitive to herbicides, complicating management, especially for broadleaf weeds where selective herbicides are ineffective. Growers have expressed a strong interest in accessing pre-emergent herbicides for the papaya industry, as these could significantly improve early-stage weed control.

The risk of herbicide resistance should also be considered in devising a weed management program. Specific resistance management strategies for high resistance risk (1 and 2) and moderate resistance risk (3, 4, 6, 9, 10, 12, 13, 14, 15, 18, 19, 22, 23, 27, 29, 30 and 31) herbicide modes of action are available on the CropLife Australia webpage[7].

[7] https://www.croplife.org.au/resources/programs/resistance-management/

4.3.2 Available and potential products for weed control

TABLE KEY: Note that blank fields in the table indicate no information has been provided.

Availability			
A	Available via either registration or permit approval		
P	Potential – a possible candidate to pursue for registration or permit		
P-A	Potential, already approved in the crop for another use		
Resistance risk		**Regulatory risk (refer to Appendix 7)**	
		R1	Short-term: Critical concern over retaining access
**	Moderate resistance risk	R2	Medium-term: Maintaining access of significant concern
***	High resistance risk	R3	Long-term: Potential issues associated with use - Monitoring required
Withholding Period (WHP) – Number of days from last treatment to harvest (H) or Grazing (G)			
Harvest	H	Not Required when used as directed	NR
Grazing	G	No Grazing Permitted	NG

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Nutgrass (*Cyperus rotundus*) **Priority: High**							
Rated as a high priority in QLD & WA. Prefers damp, water-logged soils but the nuts can survive for years underground during dry times. Herbicide options are limited and unreliable. Improve soil drainage if possible.							
Glyphosate (Roundup)	9**	Avocado / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds and **Nutgrass**. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3
Cyhalofop-Butyl + Florpyrauxifen-Benzyl (Agixa Rinskor) Corteva	1*** + 4**		Registered for control of **Nutgrass** in rice.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Dimethenamid-P (Outlook) BASF	15**		Registered for control of grass and broadleaf weeds in sweet corn, beans, peas, pumpkins and kabocha. Permitted in bulb onions for suppression of **Nutgrass** and other *Cyperus* species in bulb onions.		P		-
Halosulfuron-Methyl (Sempra)	2***		Registered for control of **Nutgrass** in turf and sugarcane.		P		-
Norflurazon (Zoliar) AgNova	12**		Registered for control of **Nutgrass** in asparagus.		P		-
Flaxleaf Fleabane (*Conyza bonariensis*) **Priority: High**							
Rated as a high priority in QLD, and as a low priority in WA. Flaxleaf Fleabane is a widespread weed that is difficult to control with herbicides. It seeds prolifically and can germinate year-round. Weed control should be targeted at small, actively growing weeds and usually multiple applications will be required. A combination of residual and knockdown herbicides should form part of an integrated approach to managing Flaxleaf Fleabane.							
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3
Paraquat (Gramoxone)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	1 G:7	A	ALL	R1

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds, including **Flaxleaf Fleabane**. Apply as a directed spray and avoid contact with crop foliage. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:1	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:7	A	ALL	R1
Amitrole	34**		Registered for control of **Fleabane** in fallow and pine plantations.		P		-
Flumioxazin (Chateau) Sumitomo	14**		Registered for control of **Flaxleaf Fleabane** in grapes, pome fruit, stone fruit, citrus, nut trees, olives, avocados and berries.		P		-
Saflufenacil (Sharpen) BASF	14**		Registered for control of **Flaxleaf Fleabane** in citrus, pome fruit & almonds.		P		-
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Mexican Clover (*Richardia brasiliensis*) **Priority: High**							
Rated as a low priority in QLD & WA. Additional industry consultation nominated Mexican Clover as a high priority for the industry. It is an annual, broadleaf weed with flowering during summer. It is a sprawling, aggressive plant that prefers damp shady places. Cultural measures including mulch and general orchard hygiene should be used as part of a broader weed management program. Common in sandy soils of the Tablelands, this sprawling weed resists herbicides like glufosinate and paraquat, making control difficult.							
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3
Oryzalin	3**	Pawpaw / Non-Bearing Fruit / directed spray	Registered in non-bearing pawpaw for control of grass and broadleaf weeds. Apply to bare soil using a directed spray at the base of the trees. Requires at least 15mm of irrigation or rain to activate.	NR	A	ALL	-
Paraquat (Gramoxone)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	1 G:7	A	ALL	R1
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray and avoid contact with crop foliage. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:1	A	ALL	R1

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Paraquat + Diquat (SpraySeed)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:7	A	ALL	R1
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		-
Blackberry Nightshade (*Solanum nigrum*) **Silverleaf Nightshade** (*Solanum elaeagnifolium*) **Priority: High**							
Rated as a low priority in QLD and WA. Additional industry consultation nominated Blackberry Nightshade as a high priority for the industry. They are competitive weeds that are widespread in all regions. Their rapid growth and poor herbicide efficacy make it a serious threat in new plantings, where it can quickly outcompete papaya seedlings. Herbicide control is effective but requires timely application and avoidance of seed set over several years to bring the soil seed bank down.							
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3
Oryzalin	3**	Pawpaw / Non-Bearing Fruit / directed spray	Registered in non-bearing pawpaw for control of grass and broadleaf weeds, including **Blackberry Nightshade** and **Silverleaf Nightshade**. Apply to bare soil using a directed spray at the base of the trees. Requires at least 15mm of irrigation or rain to activate.	NR	A	ALL	-

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Aclonifen (Emerger) Bayer	32**	Pre-Emergence	Bayer is expected to seek registration for pre-emergent control of grass and broadleaf weeds in various vegetable crops. Registered in Europe for use in potatoes, legume vegetables and cereals. **Blackberry Nightshade** is listed as moderately susceptible at a high rate.		P		-
Dimethenamid-P (Outlook) BASF	15**		Registered for control of grass and broadleaf weeds, including **Blackberry Nightshade** in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Fluroxypyr (Starane) Corteva	4**		Registered for control of **Blackberry Nightshade** in non-crop areas and pastures.		P		-
Norflurazon (Zoliar) AgNova	12**		Registered for control of **Blackberry Nightshade** in citrus, grapes, almonds, pome fruit and stone fruit.		P		-
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		-
Bellvine (*Ipomoea plebeia*) **Priority: High**							
Rated as a moderate priority in QLD, and as a low priority in WA. Additional industry consultation nominated Bellvine as a high priority for the industry. It is an invasive summer broadleaf that is difficult to control. The rapid growth pattern necessitates timely herbicide application to young and actively growing weeds. With vigorous growth, this vine can smother young plants and is challenging to control in mature plantings due to its climbing habit causing limited herbicide coverage without harming the papaya plants.							
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3
Paraquat (Gramoxone)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	1 G:7	A	ALL	R1
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray and avoid contact with crop foliage. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:1	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:7	A	ALL	R1
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		-
Barnyard Grass (*Echinochloa colona*) **Priority: Moderate**							
Rated as a moderate priority in QLD & WA. Barnyard Grass is a summer annual grass weed that is a prolific seeder, is highly competitive and is difficult to control with herbicides. It is prone to development of herbicide resistance, with confirmed cases of resistance to Group 9 and Group 5 herbicides.							
Clethodim (Select)	1***	Non-Bearing Fruit Trees	Registered in non-bearing fruit trees for control of grass weeds, including **Barnyard Grass**. Apply as a directed spray to young, actively growing weeds	NR	A	ALL	R3

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Fluazifop-P (Fusilade)	1***	Pawpaw / Directed Spray	Registered in pawpaw as a directed spray for the control of grass weeds, including **Barnyard Grass**. Apply to young, actively growing weeds.	14	A	NSW, QLD, NT & WA	-
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3
Haloxyfop (Verdict)	1***	Pawpaw / Directed Spray or Spot Spray	Registered in pawpaw for control of grass weeds, including **Barnyard Grass**. Apply as a directed spray.	NR	A	ALL	-
Oryzalin	3**	Pawpaw / Non-Bearing Fruit / directed spray	Registered in non-bearing pawpaw for control of grass and broadleaf weeds, including **Barnyard Grass**. Apply to bare soil using a directed spray at the base of the trees. Requires at least 15mm of irrigation or rain to activate.	NR	A	ALL	-
Paraquat (Gramoxone)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	1 G:7	A	ALL	R1
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray and avoid contact with crop foliage. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:1	A	ALL	R1

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Paraquat + Diquat (SpraySeed)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:7	A	ALL	R1
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		-
Crowsfoot Grass (*Dactyloctenium aegyptium*) **Priority: Moderate**							
Rated as a moderate priority in QLD & WA. Crowsfoot Grass is a summer annual grass weed that is a prolific seeder, is highly competitive and is difficult to control with herbicides.							
Clethodim (Select)	1***	Non-Bearing Fruit Trees	Registered in non-bearing fruit trees for control of grass weeds, including **Crowsfoot Grass**. Apply as a directed spray to young, actively growing weeds	NR	A	ALL	R3
Fluazifop-P (Fusilade)	1***	Pawpaw / Directed Spray	Registered in pawpaw as a directed spray for the control of grass weeds, including **Crowsfoot Grass**. Apply to young, actively growing weeds.	14	A	NSW, QLD, NT & WA	-
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3
Haloxyfop (Verdict)	1***	Pawpaw / Directed Spray or Spot Spray	Registered in pawpaw for control of grass weeds, including **Crowsfoot Grass**. Apply as a directed spray.	NR	A	ALL	-

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Oryzalin	3**	Pawpaw / Non-Bearing Fruit / directed spray	Registered in non-bearing pawpaw for control of grass and broadleaf weeds. Apply to bare soil using a directed spray at the base of the trees. Requires at least 15mm of irrigation or rain to activate.	NR	A	ALL	-
Paraquat (Gramoxone)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	1 G:7	A	ALL	R1
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray and avoid contact with crop foliage. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:1	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:7	A	ALL	R1
Dimethenamid-P (Outlook) BASF	15**		Registered for control of grass and broadleaf weeds, including **Crowsfoot Grass** in sweet corn, beans, peas, pumpkins and kabocha.		P		-
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Couch Grass (*Cynodon dactylon*) **Priority: Moderate**							
Rated as a moderate priority in QLD & WA. Couch Grass is a widespread, perennial weed that grows year-round in most areas. Herbicide control is effective provided it is targeted to young, actively growing weeds. Multiple applications are usually required.							
Clethodim (Select)	1***	Non-Bearing Fruit Trees	Registered in non-bearing fruit trees for control of grass weeds. Apply as a directed spray to young, actively growing weeds	NR	A	ALL	R3
Fluazifop-P (Fusilade)	1***	Pawpaw / Directed Spray	Registered in pawpaw as a directed spray for the control of grass weeds. Apply to young, actively growing weeds.	14	A	NSW, QLD, NT & WA	-
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3
Haloxyfop (Verdict)	1***	Pawpaw / Directed Spray or Spot Spray	Registered in pawpaw for control of grass weeds, including **Couch Grass**. Apply as a directed spray.	NR	A	ALL	-
Oryzalin	3**	Pawpaw / Non-Bearing Fruit / directed spray	Registered in non-bearing pawpaw for control of grass and broadleaf weeds. Apply to bare soil using a directed spray at the base of the trees. Requires at least 15mm of irrigation or rain to activate.	NR	A	ALL	-
Paraquat (Gramoxone)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	1 G:7	A	ALL	R1

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray and avoid contact with crop foliage. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:1	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:7	A	ALL	R1
Norflurazon (Zoliar) AgNova	12**		Registered for suppression of **Couch Grass** in citrus, grapes, almonds, pome fruit and stone fruit.		P		-
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		-
Caltrop (*Tribulus terrestris*) **Priority: Low**							
Rated as a low priority in QLD & WA. Caltrop is an annual, summer-growing broadleaf that grows as a vine and has sharp spines on the fruiting structures. Established plants develop a strong taproot making herbicide control difficult.							
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Oryzalin	3**	Pawpaw / Non-Bearing Fruit / directed spray	Registered in non-bearing pawpaw for control of grass and broadleaf weeds, including **Caltrop**. Apply to bare soil using a directed spray at the base of the trees. Requires at least 15mm of irrigation or rain to activate.	NR	A	ALL	-
Paraquat (Gramoxone)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	1 G:7	A	ALL	R1
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray and avoid contact with crop foliage. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:1	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:7	A	ALL	R1
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		-
Slender Celery (*Apium leptophyllum*) **Priority: Low**							
Rated as a low priority in QLD and WA. Slender Celery is a widespread, annual broadleaf weed which flowers in summer. Herbicide control options are limited and should be supplemented with cultural measures to minimise weed growth in orchards.							
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3
Oryzalin	3**	Pawpaw / Non-Bearing Fruit / directed spray	Registered in non-bearing pawpaw for control of grass and broadleaf weeds. Apply to bare soil using a directed spray at the base of the trees. Requires at least 15mm of irrigation or rain to activate.	NR	A	ALL	-
Paraquat (Gramoxone)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	1 G:7	A	ALL	R1
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray and avoid contact with crop foliage. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:1	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:7	A	ALL	R1
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Marshmallow (*Malva parviflora*) **Priority: Low**							
Rated as a low priority in QLD & WA. Marshmallow is adapted to a wide variety of environments and highly competitive weed. Control with knockdown herbicides can be unreliable.							
Carfentrazone-Ethyl (Spotlight)	14**	Tropical & Sub-Tropical Fruit / directed spray or spot spray	Registered in tropical & sub-tropical fruit for control of grass & broadleaf weeds, including **Marshmallow**. If weeds are already present, use as a spike in a mixture with glyphosate or paraquat.	NR	A	ALL	-
Carfentrazone + Glyphosate (Broadway) FMC	14**+ 9**	Tropical & Sub-Tropical Fruit / directed spray or spot spray	Registered in tropical & sub-tropical fruit for control of grass & broadleaf weeds, including **Marshmallow**. Apply as a directed spray or spot spray.	NR G:14	A	ALL	R3
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3
Oryzalin	3**	Pawpaw / Non-Bearing Fruit / directed spray	Registered in non-bearing pawpaw for control of grass and broadleaf weeds. Apply to bare soil using a directed spray at the base of the trees. Requires at least 15mm of irrigation or rain to activate.	NR	A	ALL	-
Oxyfluorfen (Goal)	14**	Papaya / Directed Spray	Registered in papaya for control of various grass and broadleaf weeds, including **Marshmallow**. If weeds are already present, use as a spike in a mixture with glyphosate or paraquat.	NR NG	A	ALL	-

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Paraquat (Gramoxone)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	1 G:7	A	ALL	R1
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray and avoid contact with crop foliage. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:1	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:7	A	ALL	R1
Flumioxazin (Chateau)	14**		Registered for control of various grass and broadleaf weeds, including **Marshmallow** in grapevines, pome fruit, stone fruit, citrus, tree nuts, olives, avocados and blueberries.		P		-
Fluroxypyr (Starane) Corteva	4**		Registered for control of **Small Flowered Mallow** in fallows.		P		-
Isoxaben (Gallery) Corteva	29**		Registered for control of **Small Flowered Mallow** in non-crop, forests, fencelines, tree fruit & nut orchards, vineyards, nursery & amenity tree plantings and pyrethrum.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Johnson Grass (*Sorghum halepense*) **Priority: Low**							
Rated as a low priority in QLD & WA. Johnson Grass is a large, summer growing perennial that is difficult to eradicate with herbicides.							
Clethodim (Select)	1***	Non-Bearing Fruit Trees	Registered in non-bearing fruit trees for control of grass weeds, including seedling **Johnson Grass**. Apply as a directed spray to young, actively growing weeds	NR	A	ALL	R3
Fluazifop-P (Fusilade)	1***	Pawpaw / Directed Spray	Registered in pawpaw as a directed spray for the control of grass weeds, including **Johnson Grass**. Apply to young, actively growing weeds.	14	A	NSW, QLD, NT & WA	-
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3
Haloxyfop (Verdict)	1***	Pawpaw / Directed Spray or Spot Spray	Registered in pawpaw for control of grass weeds, including **Johnson Grass**. Apply as a directed spray.	NR	A	ALL	-
Oryzalin	3**	Pawpaw / Non-Bearing Fruit / directed spray	Registered in non-bearing pawpaw for control of grass and broadleaf weeds. Apply to bare soil using a directed spray at the base of the trees. Requires at least 15mm of irrigation or rain to activate.	NR	A	ALL	-
Paraquat (Gramoxone)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	1 G:7	A	ALL	R1

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray and avoid contact with crop foliage. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:1	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:7	A	ALL	R1
Norflurazon (Zoliar) AgNova	12**		Registered for suppression of **Johnson Grass** in citrus, grapes, almonds, pome fruit and stone fruit.		P		-
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		-
Shepherd's Purse (*Capsella bursapastoris*) **Priority: Low**							
Rated as a low priority in QLD & WA. Shepherd's Purse is an erect, annual broadleaf which is adapted to a wide range of environments. Herbicide options are limited.							
Glufosinate (Basta)	10**	Tropical & Sub-Tropical Fruits, Inedible Peel / directed or shielded spray	Registered in tropical & sub-tropical fruits, inedible peel for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk.	NR G:56	A	ALL	R3
Glyphosate (Roundup)	9**	Tropical & Sub-Tropical Fruits / directed spray, shielded spray or wick wiper	Registered in tropical & sub-tropical fruits for control of various grass and broadleaf weeds. Do not allow spray to contact any part of the tree, including the trunk. Time application to flowering nutgrass. Multiple applications will be required.	NR	A	ALL	R3

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Oryzalin	3**	Pawpaw / Non-Bearing Fruit / directed spray	Registered in non-bearing pawpaw for control of grass and broadleaf weeds. Apply to bare soil using a directed spray at the base of the trees. Requires at least 15mm of irrigation or rain to activate.	NR	A	ALL	-
Paraquat (Gramoxone)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	1 G:7	A	ALL	R1
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray and avoid contact with crop foliage. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:1	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of annual grass and broadleaf weeds. Apply as a directed spray or spot spray. Do not allow spray to contact any part of the tree, including the trunk. NOTE: This use pattern is not supported under the current draft APVMA review.	NR G:7	A	ALL	R1
Norflurazon (Zoliar)	12**		Registered for control of grass and broadleaf weeds, including **Shepherd's Purse** in citrus, grapes, almonds, pome fruit and stone fruit.		P		-
Saflufenacil (Sharpen) BASF	14**		Registered for control of grass and broadleaf weeds, including **Shepherd's Purse** in established citrus, pome and almond orchards.		P		-
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		-

4.4 Plant Growth Regulator Priorities of Papaya

4.4.1 Plant Growth Regulator (PGR) priorities

PGR Issue	Priority
Post-harvest ripening	H

Our industry consultation identified post-harvest ripening as a high priority PGR issue for papaya. Fruit harvested during the cooler winter months often fails to develop the consumer-desirable, ripe skin colours, even though the fruit is at harvest maturity and internally is ripe and ready to consume. Green fruit is less marketable and consequently downgraded or discarded. Ethephon is an important tool used for de-greening of fruit at harvest.

4.4.2 Available and potential Plant Growth Regulators

TABLE KEY: Note that blank fields in the table indicate no information has been provided.

Availability		Regulatory risk (refer to Appendix 7)	
A	Available via either registration or permit approval	R1	Short-term: Critical concern over retaining access
P	Potential - a possible candidate to pursue for registration or permit	R2	Medium-term: Maintaining access of significant concern
P-A	Potential, already approved in the crop for another use	R3	Long-term: Potential issues associated with use - Monitoring required

Withholding Period (WHP) – Number of days from last treatment to harvest (H) or Grazing (G)			
Harvest	H	Not Required when used as directed	NR
Grazing	G	No Grazing Permitted	NG

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use	WHP (days)	Availability	States	Regulatory risk
Post-harvest ripening **Priority: High**							
Rated as a high priority in QLD and as a low priority in WA. Fruit harvested during the cooler winter months often fails to develop the consumer-desirable, ripe skin colours, even though the fruit is at harvest maturity and internally is ripe and ready to consume. Green fruit is less marketable and consequently downgraded or discarded. Ethephon is an important tool used for de-greening of fruit at harvest.							
1-Methylcyclopropene (Smartfresh)	PGR	Papaya / Post-Harvest Treatment	Registered in papaya to improve quality after shipping, storage and handling. Apply as soon after harvest as possible.	NR	A	ALL	-
Ethephon PER80746	PGR	Papaya / Post-Harvest treatment	Permitted in papaya as a post-harvest treatment for **fruit de-greening**. Apply 1 treatment as a post-harvest dip, immersing the fruit for 1 minute.	NR	A	NSW, NT, QLD & WA	-

5. References

5.1 Information:

AgChem Access Priority Access Forum	https://www.agrifutures.com.au/national-rural-issues/agvet-chemicals/
Australian Pesticide and Veterinary Medicines Authority	www.apvma.gov.au
APVMA Chemical review	https://apvma.gov.au/chemicals-and-products/chemical-review/listing
APVMA MRLs	www.legislation.gov.au/F2023L01350/latest/text
APVMA Permit search	Agricultural And Veterinary Permits Search - portal.apvma.gov.au
APVMA Product search	Public Chemical Registration Information System Search - portal.apvma.gov.au
Codex MRL database	http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/
Cotton Pest Management Guide 2023-24	https://www.cottoninfo.com.au/publications/cotton-pest-management-guide
CropLife Australia	https://www.croplife.org.au/
Hort Innovation	www.horticulture.com.au

5.2 Abbreviations and Definitions:

APVMA	Australian Pesticides and Veterinary Medicines Authority
IPM	Integrated pest management
LOQ	Limit of quantification
MRL	Maximum residue limit (mg/kg or ppm)
Pesticides	Plant protection products (fungicide, insecticide, herbicide, nematicides, rodenticides, etc.).
Plant pests	Diseases, insects, nematodes, rodents, viruses, weeds, etc.
SARP	Strategic Agrichemical Review Process
TBC	To be confirmed
WHP	Withholding Period

5.3 Acknowledgements:

Thanks go to the many industry people who contributed information and collaborated on the review of this report.

6. Appendices

Appendix 1. Products available for disease control in papaya
Appendix 2. Products available for control of insects and other pests in papaya
Appendix 3. Products available for weed control in papaya
Appendix 4. Plant Growth Regulators available in papaya
Appendix 5. Current permits for use in papaya
Appendix 6. Papaya Maximum Residue Limits (MRLs)
Appendix 7. Papaya regulatory risk assessment

Appendix 1. Products available for disease control in papayas

Active Ingredient (Trade Name)	Chemical Group	Situation	Diseases / Comments	States	WHP Days	Regulatory Risk
Bacillus amyloliquefaciens strain QST713 (Serenade Opti) Bayer	BM02	Tropical Fruit / Excluding Banana	Anthracnose (*Colletotrichum* spp.) Suppression of: Stem End Rot	ALL	NR	-
Bacillus amyloliquefaciens Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	BM02	Tropical Fruit / Excluding Banana	Anthracnose (*Colletotrichum* spp.) Suppression of: Stem End Rot	ALL	NR	-
Bromo Chloro Dimethyl Hydatoin (BCDMH)	-	Sanitiser / Post-Harvest Treatment	External Rot Causing Organisms	ALL	NR	-
Bupirimate (Nimrod)	8	Fruit trees / Non-bearing	Powdery Mildew	ALL	NR	-
Chlorine	-	Sanitiser / Post-Harvest Treatment	Bacteria and Fungi	ALL	NR	-
Chloropicrin + 1,3-Dichloropropene (Telone C-35)	8B	Soil Fumigant	Soil-borne diseases (including *Fusarium* & *Verticillium* Wilts, *Rhizoctonia*, *Pythium*)	ALL	NR	-
Chlorothalonil PER12592	M5	Papaya	Black Spot (*Asperisporium caricae*) Brown Spot (*Corynespora cassicola*)	ALL (excl. VIC)	3	R3
Copper as Cupric Hydroxide	M1	Tropical Fruit	Phytophthora Stem Canker	QLD & NSW	1	-
Copper as Tribasic Copper Sulphate				ALL		
Copper as Copper Ammonium Acetate						
Copper as Cuprous Oxide						

Active Ingredient (Trade Name)	Chemical Group	Situation	Diseases / Comments	States	WHP Days	Regulatory Risk
Copper PER94006	M1	Tropical Fruit Crops / Excluding mango, banana & avocado	Diplodia (*Diplodia phoenicum*) Pink Disease (*Erythricium salmonicolor*)	NSW, QLD, NT & WA	1 NG	-
Copper Hydroxide PER14417	M1	Papaya	Papaya Fruit Rot (*Phytophthora palmivora*)	ALL	1	-
Didecyl Dimethyl Ammonium Chloride	-	Sanitiser / Tropical & Sub-Tropical Fruit (inedible peel) / Post-Harvest	Control of post-harvest diseases	ALL	NR	-
Difenoconazole PER12592	3	Papaya	Black Spot (*Asperisporium caricae*)	ALL (excl. VIC)	3	R3
Fludioxonil (Scholar) PER89170	12	Papaya / Post-Harvest	Anthracnose (*Colletotrichum gloeosporioides*) Stem End Rot (Botryospaeriaceae, including *Lasiodiplodia* & *Dothiorella*)	NSW, NT, QLD & WA	NR	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Papaya	Black Spot (*Asperisporium caricae*) Brown Spot (*Corynespora cassiicola*)	ALL	3 NG	-
Iodine	-	Sanitiser / Papaya	Bacteria & Fungi	ALL	NR	-
Mancozeb	M3	Pawpaw (Papaya)	Black Spot	ALL	1 NG	R2
Metalaxyl-M (Ridomil Gold 25G) PER14490	4	Pawpaw (Papaya)	Phytophthora Root Rot (*Phytophthora palmivora*) Pythium (*Pythium* spp.)	QLD	NR	-
Peroxyacetic Acid	-	Sanitiser / Post-Harvest Treatment	Bacteria	ALL	NR	-
Phosphorous Acid PER14490	P07	Pawpaw (Papaya)	Phytophthora Root Rot (*Phytophthora palmivora*) Pythium (*Pythium* spp.)	QLD	NR	-
Prochloraz	3	Pawpaw / Post-Harvest	Anthracnose (*Colletotrichum* spp.) Stem-End Rot	QLD, NSW, WA & NT	NR	R3

Active Ingredient (Trade Name)	Chemical Group	Situation	Diseases / Comments	States	WHP Days	Regulatory Risk
Propamocarb PER91912	28	Papaya Seedlings / 1-3 weeks old in nursery situations prior to planting out	Damping Off (*Pythium* spp.)	NSW, QLD, NT & WA	NR	-
Streptomyces lydicus (Actinovate) Novozymes BioAg	BM02	All Crops	Biological soil amendment to stimulate soil organisms to make nutrients more available for plant growth	ALL	NR	-
Tebuconazole	3	Pawpaw	Black Spot	ALL	3	R3
Triadimenol	3	Pawpaw	Powdery Mildew	QLD, NSW & WA	7	R3

Appendix 2. Products available for control of insects and other pests in papayas

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory Risk
1,3-Dichloropropene	-	Soil Fumigant	Plant parasitic nematodes	ALL	NR	-
Abamectin	6	Papaya / Pawpaw	Two Spotted Mite (*Tetranychus urticae*)	ALL	7 NG	-
Acetamiprid + Pyriproxyfen (Trivor) Adama PER89943	4A+7C	Papaya	Fruit Spotting Bugs (*Amblypelta nitida*, *Amblypelta lutescens*)	ALL (excl. VIC)	28 NG	R2
Bacillus thuringiensis subsp Kurstaki Strain HD-1 (DiPel)	11	Fruit	Armyworm (*Spodoptera* spp.) Cotton Bollworm (*Helicoverpa armigera*) Native Budworm (*Helicoverpa punctigera*) Cabbage Moth (*Plutella xylostella*) Cabbage White Butterfly (*Pieris rapae*) Green Looper (*Chrysodeixis eriosoma*) Light Brown Apple Moth (*Epiphyas postvittana*) Pear Looper (*Ectropis excursaria*) Soybean Looper (*Thysanoplusia orichalcea*) Vine Moth (*Phalaenoides glycinae*, *Agarista agricola*) Tobacco Looper (*Chrysodeixis argentifera*)	ALL	NR	-
Beta-Cyfluthrin (Bulldock) PER13671	3A	Papaya / Pawpaw	Banana Spotting Bug (*Amblypelta lutescens*) Fruit Spotting Bug (*Amblypelta nitida*)	NSW, QLD, NT & WA	3	-
Bifenazate (Acramite)	20D	Papaya	Two Spotted Mite (*Tetranychus urticae*)	ALL	7 G:28	-
Chloropicrin + 1,3-Dichloropropene (Telone C-35)	8B	Soil Fumigant	Plant Parasitic Nematodes Symphylans Wireworms	ALL	NR	-

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory Risk
Deltamethrin (MagMed) PER92548	3A	Tropical Fruit	Mediterranean Fruit Fly (*Ceratitis capitata*)	WA	NR	-
Dimethoate PER13859	1B	Orchard Cleanup – Fruit Fly host crops following harvest	Fruit Fly	ALL	NR	R3
Ethyl Formate	8A	Papaya / Post-Harvest Fumigant	Mites (*Dolichotetranychus floridanus*) Mealybugs (*Dysmicoccus neobervipes*) Scale (*Diaspis bromiliae*)	ALL	NR	-
Etoxazole (Paramite) PER14098	10B	Papaya	Two Spotted Mite (*Tetranychus urticae*)	WA, NT, QLD & NSW	7 NG	-
Fenbutatin Oxide (Torque) PER14097	12	Papaya	Two Spotted Mite (*Tetranychus urticae*)	ALL (excl. VIC)	7 NG	R2
Flupyradifurone (Sivanto Prime) Bayer	4D	Tropical & Sub-Tropical Fruits (inedible peel) / Excluding bananas, pineapple	Banana Spotting Bug (*Amblypelta lutescens*) Fruit Spotting Bug (*Amblypelta nitida*) Green Planthopper Mango Planthopper	ALL	3	-
Maldison	1B	Fruit Trees / Bait	Fruit Fly	ALL	3	R3
Metaldehyde	-	Horticultural Crops	Snails & Slugs	ALL	7	-
Potassium Salts of Fatty Acid (Natrasoap)	-	Fruit	Aphids Thrips Mealybug Two-Spotted Mite Spider Mite Whitefly	ALL	NR	-

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory Risk
Pyriproxyfen (Distance Ant Bait) Sumitomo	7C	Tropical Fruit	Invasive & Nuisance Ants	ALL	NR	-
Spinetoram (Success Neo) Corteva	5	Tropical & Sub-Tropical Fruit (inedible peel)	Flower-Eating Caterpillars Leafrollers Loopers Yellow Peach Moth Red-Banded Thrips Sorghum Head Caterpillar	ALL	NR NG	-
Spinosad (Entrust Organic) Corteva	5	Tropical & Sub-Tropical Fruit (inedible peel)	Flower-Eating Caterpillars Leafrollers Loopers Yellow Peach Moth Red-Banded Thrips Sorghum Head Caterpillar	ALL	NR G:14	-
Spinosad (Entrust Organic) Corteva PER89870	5	Tropical & Sub-Tropical Fruit (inedible peel) / Excluding avocado, mango & banana	Fall Armyworm (*Spodoptera frugiperda*)	ALL (excl. VIC)	NR G:14	-
Spinosad (Naturalure) Corteva	5	Tree, Fruit, Nut, Vine & Vegetable Crops / Fruit Fly Bait	Queensland Fruit Fly (*Bactrocera tryoni*) Mediterranean Fruit Fly (*Ceratitis capitata*)	ALL	NR	-
Sulfoxaflor (Transform) Corteva	4C	Assorted Tropical & Sub-Tropical Fruit (inedible peel)	Banana Spotting Bug Fruit Spotting Bug	ALL	3	-
		Papaya	Scale (*Coccidae* spp.) Mealybugs (*Planococcus* spp.)			
Trichlorfon	1B	Pawpaw	Fruit Spotting Bug	QLD, NSW & NT	2	R2
			Banana Spotting Bug	QLD & NT		

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory Risk
Trichlorfon PER12450	1B	Pawpaw (Papaya)	Queensland Fruit Fly (*Bactrocera tryoni*) Mediterranean Fruit Fly (*Ceratitis capitata*)	ALL (excl. VIC & TAS)	7 G:7	R2

Appendix 3. Products available for weed control in papayas

Active ingredient (Trade Name)	Chemical Group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory Risk
Carfentrazone (Hammer)	14**	Tropical & Sub-Tropical Fruit	Australian Crassula / Stonecrop (*Crassula* sp.), Bifora (*Bifora testiculata*), Capeweed (*Arctotheca calendula*), Chickweed (*Stellaria media*), Common Storksbill (*Erodium cicutarium*), Spiny Emex (*Emex australis*), Marshmallow (*Malva parviflora*), Paterson's Curse (*Echium plantagineum*), Sub Clover (*Trifolium subterraneum*), Wild Radish (*Raphanus raphanistrum*)	NR G:14	ALL	-
Carfentrazone + Glufosinate (Hellcat) AgNova	14**+10**	Pawpaw	Grass & Broadleaf Weeds	NR G:8	ALL	R3
Carfentrazone + Glyphosate (Broadway) FMC	14**+9**	Tropical & Sub-Tropical Fruits	Australian Crassula / Stonecrop (*Crassula* spp.), Capeweed (*Arctotheca calendula*), Chickweed (*Stellaria media*), Common Storksbill (*Erodium cicutarium*), Spiny Emex (*Emex australis*), Marshmallow (*Malva parviflora*), Paterson's Curse (*Echium plantagineum*), Sub Clover (*Trifolium subterraneum*), Wild Radish (*Raphanus raphanistrum*)	NR G:14	ALL	R3

Active ingredient (Trade Name)	Chemical Group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory Risk
Clethodim	1***	Fruit Trees / Non-Bearing	Annual Ryegrass (Lolium rigidum), Annual Phalaris (Phalaris minor), Barley Grass (Hordeum leporinum), Barnyard Grass (Echinochloa spp.), Blown Grass (Agrostis aveacea), Brome Grass (Bromus diandrus), Crowsfoot Grass (Eleusine indica), Feathertop Rhodes Grass (Chloris virgata), Liverseed Grass (Urochloa panicoides), Paradoxa Grass (Phalaris paradoxa), Red Sprangletop Grass (Leptochloa filiformis), Seedling Johnson Grass (Sorghum halepense), Silver Grass (Vulpia bromoides) – suppression only (not QLD, WA), Summer Grass (Digitaria spp.), Volunteer Sorghum (Sorghum spp.), Volunteer Wheat (Triticum aestivum), Volunteer Oats (Avena sativa), Volunteer Barley (Hordeum vulgare), Winter Grass (Poa annua)	NR	ALL	-
Fluazifop-P (Fusilade)	1***	Pawpaw	Barnyard Grass, Crowsfoot Grass, Giant Paspalum (seedling), Green Panic (seedling), Johnson Grass, Para Grass, Prairie Grass, Rhodes Grass, Stinkgrass, Summer Grass (Crabgrass)	14	NSW, QLD, NT & WA	-
Glufosinate	10**	Tropical & Sub-Tropical Fruits – Inedible Peel	Grass and Broadleaf Weeds	NR G:8	ALL	R3
Glyphosate	9**	Tropical & Sub-Tropical Fruits	Grass and Broadleaf Weeds	NR	ALL	R3

Active ingredient (Trade Name)	Chemical Group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory Risk
Haloxyfop (Verdict)	1***	Pawpaw	Couch Grass, Rhodes Grass, Slender Rats Tail Grass, Buffel Grass, Green Panic, Johnson Grass, Kikuyu, *Paspalum* spp., *Setaria* spp., Annual Ryegrass, Barley Grass, Barnyard Grass, Brome Grass, Crowsfoot Grass, Lesser Canary Grass, Liverseed Grass, Mossman River Grass, Paradoxa Grass, Summer Grass, Volunteer Cereals, Wild Oats	NR	ALL	-
Isoxaben (Gallery)	29**	Tree Fruits / Non-Bearing	Broadleaf Weeds	NR	ALL	-
Oryzalin	3**	Pawpaw / Non-Bearing	Barnyard Grass, Guinea Grass, Love Grass, Paradoxa Grass, Pigeon Grass, Spiny Burr (Gentle Annie, Innocent Weed), Summer Grass, Crab Grass, Deadnettle, Fat Hen, Fumitory, Portulaca (Pigweed), Sowthistle, Wireweed (Hogweed), Brassica species, Blackberry Nightshade, Caltrop, Paddymelon, Silverleaf Nightshade	NR	ALL	
Oxyfluorfen (Goal)	14**	Papaya / directed spray	Grass & Broadleaf Weeds	NR NG	ALL	-
Paraquat (Gramoxone)	22**	Orchards / directed spray or spot spray	Annual Grass & Broadleaf Weeds	NR G:1	ALL	R1
Paraquat + Amitrole (Guerilla) Imtrade	22** + 34**	Orchards / Directed Spray	Annual grass and broadleaf weeds Flaxleaf Fleabane	NR G:1	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	Orchards / directed spray or spot spray	Grass and Broadleaf Weeds	NR G:1	ALL	R1

Chemical Group Resistance Risk: ** Moderate, *** High

Appendix 4. Plant Growth Regulators available in papayas

Active ingredient (Trade Name)	Chemical Group	Situation	Comment / Use	WHP (days)	States	Regulatory risk
1-Methylcyclopropene (Smartfresh)	PGR	Papaya / Post-Harvest Treatment	To improve quality after shipping, storage and handling	NR	ALL	-
Ethephon PER80746	PGR	Papaya / Post-Harvest treatment	Fruit De-Greening	NR	NSW, NT, QLD & WA	-

Appendix 5. Current permits for use in papayas

Permit ID	Description	Date Issued	Expiry Date	Permit holder
PER12592 Version 2	Chlorothalonil & Difenoconazole / Papaya / Black Spot & Brown Spot	14-Aug-11	30-Apr-25	Hort Innovation
PER89870 Version 2	Spinosad (Entrust Organic) / Tropical & Sub-Tropical Fruit / Fall Armyworm	21-Jul-20	31-Jul-25	Hort Innovation
PER80746 Version 2	Ethephon / Papaya / Crop Ripening	18-Aug-15	31-Aug-25	Hort Innovation
PER92548	Deltamethrin (MagMed) / Tropical Fruit / Mediterranean Fruit Fly	07-Sep-22	30-Sep-25	Sustainable Ventures
PER89943 Version 2	Acetamiprid + Pyriproxyfen (Trivor) / Papaya / Fruit Spotting Bugs	29-Jan-21	30-Nov-25	Hort Innovation
PER12450 Version 7	Trichlorfon / Pawpaw / Fruit Fly	06-Oct-11	30-Nov-25	Hort Innovation
PER93053	Zinc Phosphide (RatOff) / Tropical & Sub-Tropical Fruits / Rats & Mice	06-Dec-23	30-Nov-25	Animal Control Technologies
PER91912	Propamocarb / Pawpaw or Papaya (seedlings) / Damping Off	15-Dec-21	31-Dec-26	Hort Innovation
PER14490 Version 3	Metalaxyl-M, Metalaxyl & Phosphorous Acid / Papaya (Pawpaw) / Phytophthora Root Rot & Pythium	04-Apr-14	31-Mar-27	Hort Innovation
PER13671 Version 4	Beta-Cyfluthrin (Bulldock) / Papaya / Fruit Spotting Bug & Banana Spotting Bug	28-Nov-12	30-Nov-27	Hort Innovation
PER14098 Version 3	Etoxazole (Paramite) / Papaya / Two Spotted Mite	03-Oct-13	31-Mar-28	Hort Innovation
PER14097 Version 4	Fenbutatin Oxide (Torque) / Papaya (Pawpaw) / Two Spotted Mite	31-Oct-13	31-Mar-28	Hort Innovation
PER89170 Version 3	Fludioxonil (Scholar) / Papaya / Anthracnose & Stem End Rot	12-Feb-20	28-Feb-29	Hort Innovation
PER94006	Copper / Tropical Fruits / Diplodia & Pink Disease	07-Aug-24	31-Aug-29	NT Farmers Association
PER14417 Version 3	Copper Hydroxide / Papaya / Phytophthora Fruit Rot	28-Feb-14	30-Sep-29	Hort Innovation

Appendix 6. Papaya Maximum Residue Limits (MRLs)

CODEX commodity groupings of papaya and subgroups:

	Fruits
FI 0030	Assorted tropical & sub-tropical fruits, inedible peel
FI 2022	Tropical & sub-tropical, inedible smooth peel, large
FI 0350	Papaya
FI 2495	Pawpaw

Note: All Australian papaya production is essentially consumed in the domestic market. The minor export volumes of fresh papaya (7 tonnes for the year ending June 2023) are destined for New Zealand (48%), Brunei, Hong Kong and Singapore (14% each). Available information indicates that in the absence of specific limits in legislation, that some countries defer to Codex, followed by EU MRL standards, or apply a 0.01ppm default value. Food exported to New Zealand from Australia may be legally sold if it complies with Australian requirements. MRLs and legislation are subject to change; the values presented should not be relied on.

Chemical	Codex Code	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Abamectin	FI 0350	Papaya	0.1	0.01
Acetamiprid	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	0.2	-
Aldrin & Dieldrin		Fruits	E0.05	-
Amitrole	FI 0350	Papaya	*0.01	-
Azoxystrobin	FI 0350	Papaya	-	Po4
Bifenazate	FI 0350	Papaya	2	-
Carfentrazone-ethyl	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	*0.05	-
Chlorfenapyr	FI 0350	Papaya	-	0.3
Chlorothalonil	FI 0350	Papaya	10	20
Clothianidin	FI 0350	Papaya	-	*0.01
Cyfluthrin	FI 0350	Papaya	T0.2	-
Cypermethrins	FI 0350	Papaya	-	0.5
DDT		Fruits	E1	-
Diazinon		Fruits {except citrus fruits, grapes, olives, peach}	0.5	-
Dicofol		Fruits {except strawberry}	5	-
Didecyl Dimethyl Ammonium Chloride	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	20	-
Difenoconazole	FI 0350	Papaya	1	0.2
Diphenylamine		Fruits {except apple, pear}	0.5	-
Diquat		Fruits	*0.05	-
Dithianon		Fruits {except blueberries}	2	-
Dithiocarbamates	FI 0350	Papaya	5	5
2,2-DPA	FI 0350	Papaya	*0.1	-
Endosulfan	FI 0350	Papaya	-	0.5
Ethephon	FI 0350	Papaya	T1	-
Etoxazole	FI 0350	Papaya	T0.1	-
Fenbutatin Oxide	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	5	-

Chemical	Codex Code	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Fipronil	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel {except banana, custard apple}	T*0.01	-
Fluazifop-p-butyl	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel {except avocado, banana}	0.05	-
Fludioxonil	FI 0350	Papaya	T5	Po5
Fluopyram	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel {except banana, pineapple}	2	-
Flupyradifurone	FI 0350	Papaya	0.5	-
Fluxapyroxad	FI 0350	Papaya	-	1
Glufosinate and Glufosinate-ammonium	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	0.2	-
		Assorted Tropical & Sub-Tropical Fruits – Inedible Peel {except banana, kiwifruit}	-	0.1
Glyphosate	FI 0350	Papaya	*0.05	-
Haloxyfop	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	*0.05	-
Imidacloprid	FI 0350	Papaya	0.2	-
Inorganic Bromide		Fruits {except avocado, citrus fruits, dried fruits, strawberry}	20	-
Isocycloseram	FI 0350	Papaya	0.3	-
Isoxaben	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	*0.01	-
Maldison		Fruits {except berries & other small fruits, citrus fruits, dried fruits, stone fruits}	2	-
Mefentrifluconazole	FI 0350	Papaya	-	0.5
Metalaxyl	FI 0350	Papaya	*0.01	-
Metaldehyde		Fruits	1	-
Methiocarb		Fruits {except citrus fruits, grapes}	T0.1	-
Methoxyfenozide	FI 0350	Papaya	-	1
Methyl bromide	FI 0350	Papaya	*0.05	-
Oryzalin		Fruits	0.1	-
Oxyfluorfen	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	*0.01	-
Paclobutrazol	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel {except avocado, mango}	*0.01	-
Paraquat		Fruits {except olives}	*0.05	-
	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	-	*0.01
Pendimethalin	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	*0.05	-
Phosphine	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	T*0.01	-
Phosphorous Acid	FI 0350	Papaya	T100	-
Piperonyl butoxide		Fruits	8	-
Pirimicarb		Fruits {except blackberries}	0.5	-
Prochloraz	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	-	Po7
	FI 0350	Papaya	5	-
Pyraclostrobin	FI 0350	Papaya	-	0.15

Chemical	Codex Code	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Pyrethrins		Fruits	1	-
Pyriproxyfen	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	0.3	-
	FI 0350	Papaya	-	0.3
Simazine		Fruits	*0.1	-
Spinetoram	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	0.3	-
Spinosad	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	0.3	-
Spirodiclofen	FI 0350	Papaya	-	*0.03
Spiromesifen	FI 0350	Papaya	-	0.7
Spirotetramat	FI 0350	Papaya	-	0.4
Sulfoxaflor	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel {except banana, pineapple}	0.5	-
Tebuconazole	FI 0350	Papaya	0.2	2
Teflubenzuron	FI 0350	Papaya	-	0.4
Thiabendazole	FI 0350	Papaya	-	Po10
Thiamethoxam	FI 0350	Papaya	-	*0.01
Triadimenol	FI 0350	Papaya	0.2	-
Trichlorfon	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel	T3	-
Trifloxystrobin	FI 0030	Assorted Tropical & Sub-Tropical Fruits – Inedible Peel {except banana, pineapple}	2	-
	FI 0350	Papaya	-	0.6
Triflumizole	FI 0350	Papaya	-	2
Trifluralin		Fruits	*0.05	-

NOTE: MRLs are constantly under review and subject to change. Check for current MRLs and do not rely on the values stated above.
Note: Available information indicates that in the absence of specific limits in legislation, some countries defer to Codex, followed by EU MRL standards or apply a 0.01ppm default value. Food exported to New Zealand from Australia may be legally sold if it complies with Australian requirements. MRLs and legislation are subject to change; the values presented should not be relied on.

* Indicates that an MRL is at the Limit of Quantitation (LOQ)
T = Temporary MRL
E = The MRL is based on extraneous residues
Po = The MRL accommodates post-harvest treatment of the commodity

Sources:
APVMA MRLs: Agricultural and Veterinary Chemicals Code (MRL Standard) Instrument 2023. Compilation 5. Prepared 14 September 2024.
CODEX MRLs: CODEX Alimentarius International Food Standards database (August 2024), http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/

Appendix 7. Papaya regulatory risk assessment

Papaya
Agrichemical Regulatory
Risk Assessment

March 2024

Regulatory pressures on agrichemicals are increasing globally, with many being either restricted or withdrawn from use. For older agrichemicals these pressures are often the result of reconsiderations involving new or refined risk assessment methodologies that requiring the generation of new data. A consequence of which can be that many of these agrichemicals are not meeting contemporary risk assessment standards as the necessary data is unavailable, or where data is available, the risk posed is considered unacceptable.

The use of agrichemicals can also be impacted through differences in standards between trading partners. The lack of an appropriate pesticide maximum residue limit (MRL) in an importing country can, for practical purposes, effectively prohibit use in the exporting country so as to ensure compliance, as a MRL breach would adversely affect market access.

The effects of the above are greater regulatory pressure placed on the use of individual agrichemicals or chemical groups. As a consequence it is possible that the number of approved agrichemical options could be adversely impacted.

To assist strategic planning, with respect to future pest management options, the following tables have been developed to highlight the regulatory threats to agrichemicals currently approved for the management of the pests and diseases in almonds as well as current initiatives aimed at addressing identified pest management deficiencies.

Papaya Agrichemical Regulatory Risk Assessment

R1	Short-term: Critical concern over retaining access
R2	Medium-term: Maintaining access of significant concern
R3	Long-term: Potential issues associated with use - Monitoring required

Active Constituents	Chemical group	Problem	Comment
INSECT AND OTHER PESTS			
Abamectin	**6**	Two-spotted (Red spider) mite (PER14097)	EU: Use restricted to permanent greenhouses
Acetamiprid + pyriproxyfen	**4A + 7C**	Banana-spotting bug/Fruit spotting bug (PER89943)	Acetamiprid APVMA: Under review EU: Under review
		Mealybugs and scale (PER89943)	
		Mediterranean fruit fly (PER89943)	
		Plant hoppers/Leaf hoppers (PER89943)	
		Queensland fruit fly (PER89943)	
B thuringiensis	**11A**	Helicoverpa species	EU: Under review for renewal
		Loopers	
Beta-cyfluthrin	**3A**	Banana-spotting bug/Fruit spotting bug (PER13671)	EU/UK: No authorisation
Bifenazate	**20D**	Two-spotted (Red spider) mite	Canada: Under review EU: Use restricted to non-edible crops in permanent greenhouses
Dichlorvos	**1B**	Mediterranean fruit fly (PER6338 Fruit fly trap toxicant)	EU/UK: No authorisation
Dimethoate	**1B**	Orchard clean-up following harvest (PER13859)	Codex: No MRL. EU/UK: Not authorised
Etoxazole	**10B**	Two-spotted (Red spider) mite (PER14098)	EU: Only uses on greenhouse ornamentals approved & Candidate for substitution
Fenbutatin oxide	**12B**	Two-spotted (Red spider) mite (PER14097)	APVMA: nominated for review Codex: To be reviewed by JMPR. EU/UK: No authorisation in place USA: Under review
Fipronil	**2B**	Queensland fruit fly (Trap toxicant)	APVMA: Under review Codex: Re-evaluation completed, many MRLs withdrawn EU/UK: No authorisation in place USA: Under review

Papaya Agrichemical Regulatory Risk Assessment

Active Constituents	Chemical group	Problem	Comment
Flupyradifurone	**4D**	Banana-spotting bug/Fruit spotting bug	EU: Under review
		Green plant hopper	
		Mango plant hopper	
Indoxacarb	**22A**	Tropical fire ant	Canada: No authorisation EU/UK: No authorisation
Malathion/maldison	**1B**	Queensland fruit fly	APVMA: Under review Codex: Re-evaluation scheduled for 2023/24 EU: Restricted use to permanent greenhouses
		Papaya fruit fly (PER1205 Qld only)	
		Papaya fruit fly (PER80877 SA only)	
		Queensland fruit fly (PER80877 SA only)	
		Fruit flies (attractant)	
Pyrethrins	**3A**	Ants	Canada: Under review
		Aphids	
		Caterpillars	
		Leafhoppers	
		Thrips	
		Whiteflies	
Pyriproxyfen	**7C**	Ants	
		Red imported fire ant (PER87728 Qld only)	
Spinetoram	**5**	Flower eating caterpillars	EU: Approval expiry June 2024
		Leafroller moths	
		Loopers	
		Red banded thrips	
		Sorghum head caterpillar	
		Yellow peach moth	

Active Constituents	Chemical group	Problem	Comment
Spinosad	**5**	Flower eating caterpillars	
		Fruit flies	
		Leafroller moths	
		Loopers	
		Mediterranean fruit fly	
		Queensland fruit fly	
		Red banded thrips	
		Sorghum head caterpillar	
		Yellow peach moth	
		Fall armyworm(PER89870)	
Sulfoxaflor	**4C**	Banana-spotting bug/Fruit spotting bug (PER85397)	USA: Pollinator concerns EU: Restricted to permanent glasshouses only
Trichlorfon	**1B**	Banana-spotting bug/Fruit spotting bug	APVMA: nominated for review Codex: No MRLs EU/UK: No authorisations USA: No MRLs
		Fruit flies	
		Mediterranean fruit fly (PER12450)	
		Queensland fruit fly (PER12450)	
DISEASES			
Bacillus amyloliquefaciens	**BM02**	Anthracnose	
		Stem end rot	
Bupirimate	**8**	Powdery mildew (Non-bearing)	
Chlorothalonil	**M5**	Black spot (PER12592)	APVMA: nominated for review Canada: Proposed cancellation of all uses EU/UK: No authorisation in place USA: Under review
		Brown spot (Corynespora leafspot) (PER12592)	
Copper	**M1**	Phytophthora stem/root rot	EU: Candidates for substitution
		Phytophthora fruit rot (PER14417)	
Difenoconazole	**3**	Black spot (PER12592)	APVMA: nominated for review EU: Candidate for substitution USA: Under review
		Brown spot (Corynespora leafspot) (PER12592)	
Fludioxonil	**9**	Anthracnose (PER89170)	EU: Under review, & candidate for substitution
		Stem end rot (PER89170)	

Papaya Agrichemical Regulatory Risk Assessment

Active Constituents	Chemical group	Problem	Comment
Fluopyram + trifloxystrobin	**7 + 11**	Anthracnose Stem end rot	Trifloxystrobin Canada: Under review
Iodine	**M**	Bactericide	
Mancozeb	**M3**	Black spot	APVMA: nominated for review Canada: Many uses cancelled Codex: To be reviewed EU/UK: Authorisation not renewed
Metalaxyl-M/Metalaxyl	**4**	Phytophthora stem/root rot (PER14490) Pythium (PER14490)	Metalaxyl EU: Candidate for substitution Metalaxyl-M EU: Restricted use approval
Phosphorous acid	**33**	Phytophthora stem/root rot (PER14490) Pythium (PER14490)	
Prochloraz (Post-harvest)	**3**	Anthracnose Stem end rot	Codex: Periodic re-evaluation scheduled EU/UK: No authorisation
Propamocarb HCl	**28**	Pythium (PER91912)	
Sulfur	**M2**	Powdery mildew	
Tebuconazole	**3**	Black spot	APVMA: nominated for review Canada: Under review EU: Candidate for substitution USA: Under review
Triadimenol	**3**	Powdery mildew	APVMA: nominated for review Canada: No authorisation in place EU/UK: No authorisation in place USA: Registration cancelled

Active Constituents	Chemical Group	Comment
		WEEDS
Carfentrazone-ethyl	**14**	
Diquat	**22**	APVMA: Currently under review EU/UK: No authorisation in place
Fluazifop-P	**1**	
Glufosinate-ammonium	**10**	Canada: Review proposed EU/UK: No authorisation in place
Glyphosate	**9**	Ongoing issues internationally
Haloxyfop	**1**	EU/UK: No authorisation in place
Oryzalin (non-bearing)	**3**	EU/UK: No authorisation in place
Oxyfluorfen	**14**	EU: Candidate for substitution USA: Interim review decision Label amendments proposed
Paraquat	**22**	APVMA: Currently under review Canada: Review initiated EU/UK: No authorisation in place Rotterdam Convention - nomination

Active Constituents	Chemical Group	Comment
Plant growth regulators		
Ethephon (PER80746 Ripening)		
1-methylcyclopropene (Post-harvest)		

Funding statement: MT20007–Regulatory Support & Response Co-ordination. This *multi-industry* project has been funded by Hort Innovation, using *industry research and development levies* and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

Communications Manager
Hort Innovation
Level 7, 141 Walker Street
North Sydney NSW 2060
Australia
Email: communications@horticulture.com.au
Phone: 02 8295 2300