



Banana

Strategic Agrichemical Review Process (SARP)

April 2020

Hort Innovation
Project – MT19008

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Purpose of the report:

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

Date of report:

April 2020

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Strategic levy investment

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1. Summary

The Strategic Agrichemical Review Process (SARP) - Updates (MT19008) project is a strategic levy investment of the Hort Innovation Banana Fund. A Strategic Agrichemical Review Process (SARP), through the process of a desktop audit and industry liaison;

- (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 banana 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:

Common name	Scientific name
Fusarium Wilt / Panama Disease	<i>Fusarium oxysporum f. sp. cubense</i>
Yellow Sigatoka	<i>Mycosphaerella musicola</i>

1.2 Insects, mites and nematode pests

The high priority insect, mite and nematode pests of bananas are:

Common name	Scientific name
Banana Weevil Borer	<i>Cosmopolites sordidus</i>
Banana Flower Thrips	<i>Thrips hawaiiensis</i>
Banana Rust Thrips	<i>Chaetanaphothrips signipennis</i>
Banana Scab Moth	<i>Nacoleia octasema</i>
Banana Spider Mite / Strawberry Spider Mite	<i>Tetranychus lambi</i>

1.3 Weeds

The high priority weeds are:

Common Name	Scientific Name
Canadian Fleabane	<i>Conyza canadiensis</i>

2. The Australian Banana Industry

Banana production predominantly occurs in the North of Australia, in Queensland, Northern NSW, the Northern Territory and Western Australia. There is minimal international trade of fresh bananas, with some limited trade of dried banana products.

Bananas are purchased by 96% of Australian households, and with production occurring year-round in all regions they are an everyday part of most Australian diets. Bananas are Australia’s number-one selling supermarket product by volume, with over five million of them eaten daily.¹

For the year ending June 2019, Australia produced 372,204 tonnes of fresh banana, of which 371,091 tonnes supplied the fresh domestic market. The total value of production was \$604.9 million while the wholesale value of the fresh supply was \$733.0 million.

Fresh Banana Seasonality by State²

State	18/19 Tonnes	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Queensland	349,872												
Western Australia	6,514												
Northern Territory	931												
New South Wales	14,888												
Availability Legend			High		Medium		Low					None	

Production in Australia is dominated almost entirely by the Cavendish variety, which accounts for 97% of fresh production. The remaining 3% are the Lady Finger variety.

Production is relatively stable from year to year, with any variations usually caused by seasonal factors that impact on supply.

¹ Australian Banana Growers Council Inc: <https://abgc.org.au/our-industry/key-facts/>

² Hort Innovation (2020). Australian Horticulture Statistics Handbook 2018/19. [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 Banana 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 banana industry regarding pesticide access, Hort Innovation undertook a review of the pesticide requirements via a Strategic Agrichemical Review Process (SARP) in 2014. The current project is to update the SARP with the latest information and progress.

The SARP process identifies diseases, insect pests and weeds of major concern to the Banana 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 banana 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 Bananas but attempts to prioritise the major problems.

Exotic plant pests, not present in Australia, are not addressed in this document. A biosecurity plan has been developed for the banana 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. For more information visit:

<https://www.planthealthaustralia.com.au/industries/bananas/>

3.2 Minor use permits and registration

From a pesticide access perspective, the APVMA classifies bananas as a major crop. The crop fits within the APVMA crop group Crop Group 006: Assorted tropical and sub-tropical fruits – inedible peel, within the Subgroup 006B, Assorted tropical and sub-tropical, Inedible Peel, Large. Therefore, access to minor use permits can be relatively difficult. 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 banana industry is for manufacturers to register new pesticides uses in the crop.

3.3 Methods

The current update of the banana Strategic Agrichemical Review Process (SARP), which was last updated in 2014, 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: 14 January 2020 Survey closed: 28 February 2020
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 MT17019
Captured industry input	Collated and analysed survey results Consolidated and incorporated industry needs and insights

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 bananas
- Appendix 2. Products available for control of insects, mites and nematode pests in bananas
- Appendix 3. Products available for weed control in bananas
- Appendix 4. Current permits for use in bananas
- Appendix 5. Banana Maximum Residue Limits (MRLs)
- Appendix 6. Banana Agrichemical Regulatory Risk Assessment

4. Diseases, pests and weeds of bananas

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.

<https://www.croplife.org.au/resources/programs/resistance-management/>

In Chapter 4 information on regulatory risk derived from project MT17019 (Regulatory support and coordination) has been incorporated.

Some of the suggested options have no overseas MRLs (see Appendix 5).

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.

4.1 Diseases of banana

4.1.1 Disease priorities

Common name	Scientific name
High	
Fusarium Wilt / Panama Disease	<i>Fusarium oxysporum f. sp. cubense</i>
Yellow Sigatoka	<i>Mycosphaerella musicola</i>
Moderate	
Crown Rot	<i>Colletotrichum musae, Fusarium spp, Musicillium theobromae</i>
Fruit Speckle	<i>Colletotrichum musae, Fusarium spp.</i>
Leaf Spot	<i>Cordana musae</i>
Leaf Speckle	<i>Mycosphaerella musae</i>
Banana Bunchy Top Virus (BBTV)	Vector – Banana Aphid (<i>Pentalonia nigronervosa</i>)
Black Sigatoka	<i>Mycosphaerella fijiensis</i>
Banana Freckle	<i>Phyllosticta cavendishii</i>
Low	
Moko Disease	<i>Ralstonia solanacearum</i>
Bacterial Rot, Corm Rot, Soft Rot	<i>Erwinia spp.</i>
Fruit Spot	<i>Deightoniella torulosa</i>
Banana Bract Mosaic Virus (BBrMv)	Vector – Banana Aphid (<i>Pentalonia nigronervosa</i>)
Base (Butt) Rot	<i>Chalara paradoxa</i>
Anthracnose – Post-Harvest	<i>Colletotrichum musae</i>
Black Tip	<i>Deightoniella torulosa</i>
Cigar End Tip Rot	<i>Verticillium spp.</i>
Ripe Fruit Spot – Post-Harvest	<i>Gloeosporium spp.</i>
Banana Leaf Rust	<i>Uredo musae</i>
Squirter – Post-Harvest	<i>Nigrospora musae, Nigrospora sphaerica</i>

Exotic diseases represent a major threat to the banana industry. The recent detections of Panama Disease TR4 in Qld have resulted in serious biosecurity implications, particularly for those plantations directly affected. The threat of Black Sigatoka or the potential spread of the Banana Bunchy Top Virus from its containment zone highlight the need to implement restrictions on the movement of banana planting material and adherence to high standards of farm hygiene with the movement of people and equipment between farms.

Panama Disease and Yellow Sigatoka have been identified as high priority diseases for the banana industry. Panama Disease is a soil-borne fungus which is not eradicable and can survive in the soil for decades without host plants. The key to managing the disease is containment. Growers that suspect the presence of Panama Disease must report it to Biosecurity Queensland. Yellow Sigatoka is a serious and widespread disease in bananas, being endemic to all regions except WA. It is a prescribed pest meaning that growers are required to keep Yellow Sigatoka leaf levels below 5% by state government regulations. Yellow Sigatoka has the potential to mask an outbreak of the similar looking, but far more destructive exotic disease Black Sigatoka.

The disease priorities for the banana industry are similar to those identified in the last SARP in 2014. Post-harvest anthracnose has moved to a low priority having previously been seen as a high priority, suggesting that the current control measures are keeping it in check.

A planned, regular fungicide program will provide protection from common in-crop diseases and post-harvest treatment is critical to ensure that fruit retains its quality during transport to market. Growers should be vigilant about monitoring their crops for unusual plant symptoms and suspected exotic disease outbreaks should be reported to Biosecurity Agencies immediately.

In controlling fungal and bacterial diseases, the industry should be mindful of resistance management. CropLife Australia has a resistance management strategy and users must refer to it before using any product:

<http://www.croplife.org.au/industry-stewardship/resistance-management>

CropLife Australia recommends that in the absence of a specific resistance management strategy, the use of fungicides from a specific mode of action be limited to a maximum of one-third of the total. The number of consecutive applications of the same group should also be limited by rotating/alternating between products from different activity groups. An exception is the use of Group M fungicides as they have a low risk of resistance development.

<https://www.croplife.org.au/resources/programs/resistance-management/fungicide-resistance-management-strategies1/fungicide-resistance-management-strategies1-draft/>

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 6)	
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
Fusarium Wilt / Panama Disease (<i>Fusarium oxysporum f. sp. cubense</i>)							
Priority: High							
Panama Disease is a serious disease that has been found on farms in Far North Queensland. It is a soil-borne fungus which is not eradicable and can survive in the soil for decades without host plants. The key to managing the disease is containment. Growers that suspect the presence of Panama Disease must report it to Biosecurity Queensland.							
Benzalkonium chloride, Didecyl Dimethyl ammonium chloride (PER86485)	-	Sanitation	NR	A	ALL	Used for sanitation and decontamination of motor vehicles, tools, equipment and footwear that come into contact with plant material or soil infected with Fusarium oxysporum f. sp. Cubense (Race 4), the fungus that causes Panama Disease	
Didecyl Dimethyl Ammonium Chloride (Steri-Max Biocide)	-	Sanitation & Water Treatment	NR	A	ALL	A broad spectrum sanitation and water treatment product for the control of the spread of Panama disease in bananas. Used for sanitation and decontamination of machinery, vehicles, packing sheds and any other general disinfection, as well as in foot bath hygiene treatments.	

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Yellow Sigatoka / Leaf Spot (<i>Mycosphaerella musicola</i>) Priority: High							
Yellow Sigatoka is a serious and widespread disease in bananas, being endemic to all regions except WA. It is a prescribed pest meaning that growers are required to keep Yellow Sigatoka leaf levels below 5% by state government regulations. Yellow Sigatoka has the potential to mask an outbreak of the similar looking, but far more destructive exotic disease Black Sigatoka.							
<i>Bacillus amyloliquifaciens</i> Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	44	Protectant	NR	A	ALL	Registered for use in bananas for control of Yellow Sigatoka and suppression of Common Leaf Speckle. Intervals between fungicide applications should be 14-21 days, but should be modified for locality, disease conditions and leaf emergence rates.	-
Chlorothalonil (Bravo)	M5	Protectant	1	A	QLD, NSW, NT & WA	Registered in bananas for the control of Leaf Spot and Leaf Speckle. Apply as a protectant with spray intervals: Nth Qld: Jan-Mar 14 days; After Mar 21 days and then 28-35 days during dry months Sth Qld: Dec-Apr 21 days WA: Nov-May 10-14 days; May-Nov 14-21 days NSW: Nov-May 21 days	R3
Copper (Cu) as copper ammonium complex	M1	Protectant	1	A	ALL	Registered in bananas for the control of Yellow Sigatoka and Phytophthora stem canker. Yellow Sigatoka: Spray monthly from Dec-May when weather conditions favour disease.	-
Difenoconazole (Score)	3	Protectant & Curative	1	A	QLD, NSW & NT	Registered for the control Yellow Sigatoka and Black Sigatoka of bananas. NSW, Sth Qld: Commence spraying at the start of the summer rainy season. Apply at least 2 consecutive applications at 21-28 day interval. DO NOT use more than 5 Group 3 fungicides per season. NT, Nth Qld: Commence spraying at the start of the wet season. Apply at least 2 but no more than 3 consecutive sprays at 14-21 day intervals. DO NOT use more than 6 Group 3 fungicides per season. DO NOT apply during Jul-Oct period.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Epoxiconazole (Opus 75) BASF	3	Protectant & Curative	1	A	ALL	Registered in bananas for the control of Leaf Spot/Yellow Sigatoka and Leaf Speckle. DO NOT use on bananas unless bunch covers are in place. Nth Qld, NT, WA: Apply as a protectant when conditions favour disease. Apply a maximum of 2 consecutive sprays at 14-21 day intervals. Do not use more than 6 Group 3 fungicide per season, do not use during Jul-Sep period. Sth Qld, NSW: Commence spraying at the onset of wet/humid conditions. Apply a maximum of 2 consecutive sprays at 21-28 day intervals. Do not use more than 5 Group 3 fungicides per season.	R3
Fluopyram (Luna Privilege) Bayer	7	Protectant & Curative	NR	A	QLD, NSW, WA & NT	Registered in bananas for the control of Yellow Sigatoka , Leaf Speckle and Cordana leaf spot. Apply as part of a regular protectant program using spray intervals of 14-21 days. Apply a maximum of 4 applications per season.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative	1	A	ALL	Registered in bananas for the control of Yellow Sigatoka , Leaf Speckle and Cordana leaf spot. Apply as part of a regular protectant program using spray intervals of 14-21 days. Apply a maximum of 4 applications per season.	R3
Mancozeb	M3	Protectant	NR	A	ALL	Registered in bananas for the control of Leaf spot and suppression of Leaf speckle, Fruit speckle, Cordana leaf spot and Black pit. Note that addition of spraying oil is required (1 day WHP). Apply when weather conditions favour disease outbreak. NSW / Ground Application: Dec/Jan-May 21 day intervals NSW / Aerial Application: Dec/Jan-May 7-10 day intervals Sth Qld: Dec/Jan-May 21 day intervals Nth Qld, NT: Wet season – 14 day intervals; After and in the lead up to wet season – 21 day intervals; drier months – 28-35 days	R2

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Metiram (Polyram)	M3	Protectant	NR	A	ALL	Registered in bananas for the control of Leaf spot , Black Pit, Cordana Leaf Spot, Fruit Speckle and Leaf Spot on bagged bananas. Note spray oil has a 1 day WHP. Apply when weather conditions favour disease outbreak. NSW / Ground Application: Dec/Jan-May 21 day intervals Sth Qld: Dec/Jan-May 21 day intervals Nth Qld, NT: Wet season – 14 day intervals; After and in the lead up to wet season – 21 day intervals; drier months – 28-35 days.	R2
Petroleum Oil	-	Protectant	1	A	QLD, NSW, WA & NT	Registered in bananas for control of Cercospora Leaf Spot, Leaf Speckle and Cordana Leaf Spot. Apply with mancozeb or propiconazole for control of Leaf Spot , Leaf Speckle, Fruit Speckle, Cordana Leaf Spot and Black Sigatoka. Use in accordance with the appropriate label.	-
Propiconazole (Tilt)	3	Protectant & Curative	1	A	QLD, NSW, WA & NT	Registered in bananas for control of Leaf Spot , Leaf Speckle, Cordana Leaf Spot and Black Sigatoka. Must be applied with a water miscible oil. NSW, Sth Qld: Commence spraying at the start of the summer rainy season. Apply at least 2 consecutive applications at 21-28 day interval. DO NOT use more than 5 Group 3 fungicides per season. NT, Nth Qld: Commence spraying at the start of the wet season. Apply at least 2 but no more than 3 consecutive sprays at 14-21 day intervals. DO NOT use more than 6 Group 3 fungicides per season. DO NOT apply during Jul-Oct period.	R2
Pyraclostrobin (Cabrio) BASF	11	Protectant & Curative	NR	A	ALL	Registered in bananas for control of Leaf Speckle, Leaf Spot and Black Sigatoka. DO NOT use on bananas unless bunch covers are in place. Apply up to 4 sprays per season, as part of a preventative disease control program. DO NOT apply consecutive sprays of pyraclostrobin or other Group 11 fungicides.	-
Pyrimethanil (Scala) Bayer	9	Protectant	NR	A	QLD, NSW, WA & NT	Registered in bananas for control of Yellow Sigatoka , Leaf Speckle and Cordana Leaf Spot. Intervals between fungicide applications should be 14-21 days, but should be modified for locality, disease conditions and leaf emergence rates.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Tebuconazole (Folicur)	3	Protectant & Curative	1	A	QLD, NSW, WA & NT	Registered in bananas for control of Leaf Spot/Yellow Sigatoka , Leaf Speckle and Black Sigatoka. Tropical Areas: Commence spraying at the start of the wet season. Apply at least 2 but no more than 3 consecutive sprays at 14 day intervals. DO NOT use more than 6 applications per season. DO NOT apply during Jul-Sep period Sub-tropical Areas: Commence spraying at the onset of warm and humid/wet weather, normally Dec. Apply at least 2 consecutive applications at 21-28 day interval. DO NOT use more than 5 applications per season.	R3
Trifloxystrobin (Flint) Bayer	11	Protectant & Curative	NR	A	QLD, NSW, WA & NT	Registered in bananas for control of Yellow Sigatoka , Black Sigatoka and Cordana Leaf Spot. Should be used as part of a regular protectant program. Intervals between applications generally should be 14-21 days, but should be modified for locality, disease conditions and leaf emergence rates. DO NOT apply consecutive applications and apply a minimum of 2 sprays from a different activity group between any Group 11 fungicides. Tropical Areas: DO NOT use Group 11 fungicides from May-Sep. DO NOT use more than 4 applications per season.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New Mode of Action fungicide being developed for use in bananas in AU, activity on Mycosphaerella spp and other leaf diseases. Due for registration in 2023.	-
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered on various crops for diseases including various leaf spots. Bayer claims wide range of diseases controlled by this active. Fluopyram – AU MRL 0.1 mg/kg. Codex MRL 0.8 mg/kg. Trifloxystrobin – AU MRL 0.5 mg/kg. Codex MRL 0.05 mg/kg.	-
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered on Apples and Grapes for Black Spot and Powdery Mildew. BASF claims wide range of diseases controlled by this active. No MRLs for AU or Codex.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Crown Rot – Post-Harvest (<i>Colletotrichum musae</i> , <i>Fusarium</i> spp., <i>Musicillium theobromae</i>) Priority: Moderate							
Crown Rot is one of the most serious post-harvest diseases of banana. It develops as the fruit is being stored and ripened in the marketing chain. The appropriate and timely use of post-harvest fungicides is key to reducing disease incidence.							
Prochloraz (Sportak)	3	Protectant / Post-Harvest Spray	NR	A	QLD, NSW, WA & NT	Registered in bananas for post-harvest control of Anthraco nose (Black-End) . Spray fruit for 30 seconds	-
Thiabendazole (Tecto)	1	Protectant / Post-Harvest Dip	NR	A	NSW, WA	Registered in bananas for post-harvest control of Crown Rot/Black-End Rot . After the bananas have passed through the de-handing and/or washing operation, the fruit should be completely dipped for 2-4 minutes	-
Azoxystrobin + Fludioxynil (Graduate A+) Syngenta	11+12	Protectant / Post-Harvest		P		Registered as a dip, drench or flood spray for the control of various post-harvest diseases in avocados. Azoxystrobin: AU MRL T0.5 mg/kg; Codex 2 mg/kg Fludioxynil: No MRLS for AU or Codex.	-
Fludioxynil (Scholar) Syngenta	12	Protectant / Post-Harvest		P		Registered for the control of various post-harvest diseases in citrus, pome and stone fruit, mangoes, pomegranates and kiwi fruit. Used as a dip or flood spray. No MRLS for AU or Codex.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fruit Speckle (<i>Colletotrichum musae</i> , <i>Fusarium</i> spp.)							
Priority: Moderate							
Fruit Speckle occurs frequently in bananas and should be managed by a combination of mancozeb sprays and cultural controls, especially de-leafing and de-suckering to remove infection sources. As fruit matures, it becomes less susceptible to infection. Fungicide strategy is highly exposed with high reliance on mancozeb.							
Mancozeb	M3	Protectant	NR	A	ALL	Registered in bananas for control of Leaf Spot, Black Pit, Cordana Leaf Spot, Fruit Speckle and Leaf Speckle. Note that addition of spraying oil is required (1 day WHP). Apply when weather conditions favour disease outbreak. NSW / Ground Application: Dec/Jan-May 21 day intervals NSW / Aerial Application: Dec/Jan-May 7-10 day intervals Sth Qld: Dec/Jan-May 21 day intervals Nth Qld, NT: Wet season – 14 day intervals; After and in the lead up to wet season – 21 day intervals; drier months – 28-35 days	R2
Mancozeb PER81199	M3	Protectant	35	A	NSW, NT, QLD & WA	Permitted in bananas for control of Banana Fruit Speckle . Apply a maximum of 2 foliar dusting applications per season. Apply to emerging bunch before bracts are fully open (i.e. bract lift). Apply again at bunch covering.	R2
Petroleum Oil	-	Protectant	1	A	Qld, NSW, WA & NT	Registered in bananas for control of Cercospora Leaf Spot, Leaf Speckle and Cordana Leaf Spot. Apply with mancozeb for control of Leaf Spot, Leaf Speckle, Fruit Speckle , Cordana Leaf Spot and Black Sigatoka. Use in accordance with the appropriate label.	-
Leaf Spot (<i>Cordana musae</i>)							
Priority: Moderate							
Usually of minor importance in Cavendish bananas. Severe infections may not have a large impact on yields. Several fungicide options are available for managing the disease.							
Fluopyram (Luna Privilege) Bayer	7	Protectant & Curative	NR	A	Qld, NSW, WA & NT	Registered in bananas for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot . Apply as part of a regular protectant program using spray intervals of 14-21 days. Apply a maximum of 4 applications per season.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative	1	A	ALL	Registered in bananas for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot . Apply as part of a regular protectant program using spray intervals of 14-21 days. Apply a maximum of 4 applications per season.	R3
Mancozeb	M3	Protectant	NR	A	ALL	Registered in bananas for control of Leaf Spot, Black Tip, Cordana Leaf Spot , Fruit Speckle and Leaf Speckle. Note that addition of spraying oil is required (1 day WHP). Apply when weather conditions favour disease outbreak. NSW / Ground Application: Dec/Jan-May 21 day intervals NSW / Aerial Application: Dec/Jan-May 7-10 day intervals Sth Qld: Dec/Jan-May 21 day intervals Nth Qld, NT: Wet season – 14 day intervals; After and in the lead up to wet season – 21 day intervals; drier months – 28-35 days	R2
Metiram (Polyram)	M3	Protectant	NR	A	ALL	Registered in bananas for the control of Leaf spot, Black Pit, Cordana Leaf Spot , Fruit Speckle and Leaf Spot on bagged bananas. Note spray oil has a 1 day WHP. Use only on bagged bananas. Apply when weather conditions favour disease outbreak. NSW / Ground Application: Dec/Jan-May 21 day intervals Sth Qld: Dec/Jan-May 21 day intervals Nth Qld, NT: Wet season – 14 day intervals; After and in the lead up to wet season – 21 day intervals; drier months – 28-35 days.	R2
Petroleum Oil	-	Protectant	1	A	QLD, NSW, WA & NT	Registered for control of Cercospora Leaf Spot, Cordana Leaf Spot, Leaf Speckle and Black Sigatoka in bananas. Apply with a registered fungicide as specified on the label.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Propiconazole (Tilt)	3	Protectant & Curative	1	A	QLD, NSW, WA & NT	Registered in bananas for control of Leaf Spot, Leaf Speckle, Cordana Leaf Spot and Black Sigatoka. Must be applied with a water miscible oil. NSW, Sth Qld: Commence spraying at the start of the summer rainy season. Apply at least 2 consecutive applications at 21-28 day interval. DO NOT use more than 5 Group 3 fungicides per season. NT, Nth Qld: Commence spraying at the start of the wet season. Apply at least 2 but no more than 3 consecutive sprays at 14-21 day intervals. DO NOT use more than 6 Group 3 fungicides per season. DO NOT apply during Jul-Oct period.	R2
Pyrimethanil (Scala) Bayer	9	Protectant	NR	A	QLD, NSW, WA & NT	Registered in bananas for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot . Intervals between fungicide applications should be 14-21 days, but should be modified for locality, disease conditions and leaf emergence rates.	-
Trifloxystrobin (Flint) Bayer	11	Protectant & Curative	NR	A	QLD, NSW, WA & NT	Registered in bananas for control of Yellow Sigatoka, Black Sigatoka and Cordana Leaf Spot . Intervals between fungicide applications should be 14-21 days, but should be modified for locality, disease conditions and leaf emergence rates. DO NOT use consecutive applications. In the tropics, DO NOT apply Group 11 sprays from May-Sep. DO NOT use more than 4 applications of any Group 11 fungicide per season.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New Mode of Action fungicide being developed for use in bananas in AU, activity on <i>Mycosphaerella</i> spp. and other leaf diseases. Due for registration in 2023.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Leaf Speckle (<i>Mycosphaerella musae</i>) Priority: Moderate							
Closely related to Yellow Sigatoka and endemic to all regions except WA. It is a prescribed pest meaning that growers are required to keep Leaf Speckle leaf levels below 5% by state government regulations. Leaf Speckle has the potential to mask an outbreak of the similar looking, but far more destructive exotic disease Black Sigatoka.							
<i>Bacillus amyloliquifaciens</i> Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	44	Protectant	NR	A	ALL	Registered in bananas for control of Yellow Sigatoka and suppression of Common Leaf Speckle . Suppression only of Leaf Speckle. Intervals between fungicide applications should be 14-21 days, but should be modified for locality, disease conditions and leaf emergence rates.	-
Epoxiconazole (Opus) BASF	3	Protectant & Curative	1	A	ALL	Registered in bananas for control of Leaf Spot/Yellow Sigatoka and Leaf Speckle . DO NOT use on bananas unless bunch covers are in place. Nth Qld, NT, WA: Apply as a protectant when conditions favour disease. Apply a maximum of 2 consecutive sprays at 14-21 day intervals. Do not use more than 6 Group 3 fungicide per season, do not use during Jul-Sep period. Sth Qld, NSW: Commence spraying at the onset of wet/humid conditions. Apply a maximum of 2 consecutive sprays at 21-28 day intervals. Do not use more than 5 Group 3 fungicides per season.	R3
Fluopyram (Luna Privilege) Bayer	7	Protectant & Curative	NR	A	QLD, NSW, WA & NT	Registered in bananas for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot. Apply as part of a regular protectant program using spray intervals of 14-21 days. Apply a maximum of 4 applications per season.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative	1	A	ALL	Registered in bananas for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot. Apply as part of a regular protectant program using spray intervals of 14-21 days. Apply a maximum of 4 applications per season.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluxapyroxad (Sercadis) BASF	7	Protectant & Curative	NR	A	ALL	Registered in bananas for control of Yellow Sigatoka and Leaf Speckle . Apply up to 4 sprays per season as part of a preventative disease program. Spray at 14-21 day intervals.	-
Mancozeb	M3	Protectant	NR	A	ALL	Registered in bananas for control of Leaf Spot, Black Tip, Cordana Leaf Spot, Fruit Speckle and Leaf Speckle . Note that addition of spraying oil is required (1 day WHP). Apply when weather conditions favour disease outbreak. NSW / Ground Application: Dec/Jan-May 21 day intervals NSW / Aerial Application: Dec/Jan-May 7-10 day intervals Sth Qld: Dec/Jan-May 21 day intervals Nth Qld, NT: Wet season – 14 day intervals; After and in the lead up to wet season – 21 day intervals; drier months – 28-35 days	R2
Petroleum Oil		Protectant	1	A	QLD, NSW, WA & NT	Registered for control of Cercospora Leaf Spot, Cordana Leaf Spot, Leaf Speckle and Black Sigatoka in bananas. Apply with a registered fungicide as specified on the label.	-
Pyraclostrobin (Cabrio) BASF	11	Protectant & Curative	NR	A	ALL	Registered in bananas for control of Leaf Speckle , Leaf Spot and Black Sigatoka. DO NOT use on bananas unless bunch covers are in place. Apply up to 4 sprays per season, as part of a preventative disease control program. DO NOT apply consecutive sprays of pyraclostrobin or other Group 11 fungicides.	-
Pyrimethanil (Scala) Bayer	9	Protectant	NR	A	QLD, NSW, WA & NT	Registered in bananas for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot. Intervals between fungicide applications should be 14-21 days, but should be modified for locality, disease conditions and leaf emergence rates.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Tebuconazole (Folicur)	3	Protectant & Curative	1	A	QLD, NSW, WA & NT	Registered in bananas for control of Leaf Spot/Yellow Sigatoka, Leaf Speckle and Black Sigatoka. Tropical Areas: Commence spraying at the start of the wet season. Apply at least 2 but no more than 3 consecutive sprays at 14 day intervals. DO NOT use more than 6 applications per season. DO NOT apply during Jul-Sep period Sub-tropical Areas: Commence spraying at the onset of warm and humid/wet weather, normally Dec. Apply at least 2 consecutive applications at 21-28 day interval. DO NOT use more than 5 applications per season.	R3
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New Mode of Action fungicide being developed for use in bananas in AU, activity on Mycosphaerella spp and other leaf diseases. Due for registration in 2023.	-
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered on Apples and Grapes for Black Spot and Powdery Mildew. BASF claims wide range of diseases controlled by this active. No MRLs for AU or Codex.	-
Banana Bunchy Top Virus (BBTV)							
Priority: Moderate							
BBTV is transmitted by the Banana Aphid. It is a regulated pest and a containment strategy is in place to prevent the disease from spreading. It remains restricted to a small area of SE Qld and Northern NSW. Bunchy Top cannot be cured and infected plants must be destroyed.							
Glyphosate (Roundup) PER14850	M	Destruction of Infected Banana Plants	H:NR NG	A	ALL	Inject glyphosate mix into the pseudostem above the growing point. Inject suckers up to 1 metre tall at 1 point and taller plants at 2 points around the stem. No fruit from plants treated can be sold or consumed.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Black Sigatoka (<i>Mycosphaerella fijiensis</i>) Priority: Moderate							
Black Sigatoka presents a serious threat to the Australian banana industry. Movement restrictions are in place from the far northern biosecurity zones to prevent it from spreading. It has not been detected on the Australian mainland. Any new detections must be reported to Biosecurity Qld. Yellow Sigatoka and Leaf Speckle cause similar symptoms in bananas and could mask an infection with Black Sigatoka.							
Difenoconazole (Score) Syngenta	3	Protectant & Curative	1	A	QLD, NSW & NT	Registered in bananas for the control of Yellow Sigatoka and Black Sigatoka . NSW, Sth Qld: Commence spraying at the start of the summer rainy season. Apply at least 2 consecutive applications at 21-28 day interval. DO NOT use more than 5 Group 3 fungicides per season. NT, Nth Qld: Commence spraying at the start of the wet season. Apply at least 2 but no more than 3 consecutive sprays at 14-21 day intervals. DO NOT use more than 6 Group 3 fungicides per season. DO NOT apply during Jul-Oct period.	R3
Pyraclostrobin (Cabrio) BASF	11	Protectant & Curative	NR	A	ALL	Registered in bananas for the control of Leaf Speckle, Leaf Spot and Black Sigatoka . DO NOT use on bananas unless bunch covers are in place. Apply up to 4 sprays per season, as part of a preventative disease control program. DO NOT apply consecutive sprays of pyraclostrobin or other Group 11 fungicides.	-
Tebuconazole	3	Protectant & Curative	1	A	QLD, NSW, WA & NT	Registered in bananas for control of Leaf Spot/Yellow Sigatoka, Leaf Speckle and Black Sigatoka . Tropical Areas: Commence spraying at the start of the wet season. Apply at least 2 but no more than 3 consecutive sprays at 14 day intervals. DO NOT use more than 6 applications per season. DO NOT apply during Jul-Sep period Sub-tropical Areas: Commence spraying at the onset of warm and humid/wet weather, normally Dec. Apply at least 2 consecutive applications at 21-28 day interval. DO NOT use more than 5 applications per season.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Trifloxystrobin (Flint) Bayer	11	Protectant & Curative	NR	A	QLD, NSW, WA & NT	Registered in bananas for control of Yellow Sigatoka, Black Sigatoka and Cordana Leaf Spot. Should be used as part of a regular protectant program. Intervals between applications generally should be 14-21 days, but should be modified for locality, disease conditions and leaf emergence rates. DO NOT apply consecutive applications and apply a minimum of 2 sprays from a different activity group between any Group 11 fungicides. Tropical Areas: DO NOT use Group 11 fungicides from May-Sep. DO NOT use more than 4 applications per season.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New Mode of Action fungicide being developed for use in bananas in AU, activity on <i>Mycosphaerella</i> spp. and other leaf diseases. Due for registration in 2023.	-
Banana Freckle (<i>Phyllosticta cavendishii</i>) Priority: Moderate							
Banana Freckle that can affect Cavendish bananas has been successfully eradicated from the Australian mainland. Suspected detections of the disease should be reported to Biosecurity Qld. No fungicides are registered for control.							
No Control Options Available							
Moko Disease (<i>Ralstonia solanacearum</i>) Priority: Low							
Moko disease is a type of bacterial wilt pathogen. Australia is currently free of the disease but it would cause serious impacts if it were to appear. Regulation of imported plant material and ongoing surveillance are in place to protect the industry from an incursion. No fungicide options are available.							
No Control Options Available							
Bacterial Rot, Corm Rot, Soft Rot (<i>Erwinia spp</i>) Priority: Low							
Bacterial Rot infections can enter through injuries to fruit, storage root or stem and are favoured in hot, wet weather. No fungicide options are available.							
No Control Options Available							

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fruit Spot / Black Tip (<i>Deightoniella torulosa</i>)							
Priority: Low							
Fruit Spot is a minor disease that is generally controlled incidentally by the fungicide program used for other leaf diseases. No specific in-crop fungicides are registered.							
Thiabendazole (Tecto) Syngenta	1	Protectant / Post-Harvest Dip	NR	A	NSW, WA	Registered in bananas for post-harvest control of Squirter Disease, Black-End Rot, Crown Rot and <i>Fusarium</i> , <i>Deightoniella</i> , <i>Verticillium</i> spp. After the bananas have passed through the dehanding and/or washing operation, the fruit should be completely dipped for 2-4 minutes	-
Banana Bract Mosaic Virus (BBrMV)							
Priority: Low							
BBrMV is transmitted non-persistently by aphids. It can also be transmitted through planting material. Any detections must be reported to biosecurity authorities.							
No Control Options Available							
Base (Butt) Rot (<i>Chalara paradoxa</i>)							
Priority: Low							
Low priority with no control measures available.							
No Control Options Available							
Anthracnose – Post-Harvest (<i>Colletotrichum musae</i>)							
Priority: Low							
Caused by the same pathogen as Crown Rot, anthracnose can cause other post-harvest defects in bananas. It develops as the fruit is being stored and ripened in the marketing chain. The appropriate and timely use of post-harvest fungicides is key to reducing disease incidence.							
Prochloraz (Sportak)	3	Protectant / Post-Harvest Spray	NR	A	QLD, NSW, WA & NT	Registered in bananas for post-harvest control of Anthracnose (Black-End) . Spray fruit for 30 seconds	-
Thiabendazole (Tecto) Syngenta	1	Protectant / Post-Harvest Dip	NR	A	NSW, WA	Registered in bananas for post-harvest control of Squirter Disease, Black-End Rot , Crown Rot and <i>Fusarium</i> , <i>Deightoniella</i> , <i>Verticillium</i> spp. After the bananas have passed through the dehanding and/or washing operation, the fruit should be completely dipped for 2-4 minutes	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Cigar End Tip Rot (<i>Verticillium</i> spp.) Priority: Low							
Cigar End Tip Rot is a minor disease that has minimal impacts on banana quality. The appropriate and timely use of post-harvest fungicides is key to reducing disease incidence.							
Thiabendazole (Tecto) Syngenta	1	Protectant / Post-Harvest Dip	NR	A	NSW, WA	Registered in bananas for post-harvest control of Squirter Disease, Black-End Rot, Crown Rot and <i>Fusarium</i> , <i>Deighтониella</i> , Verticillium spp. After the bananas have passed through the dehanding and/or washing operation, the fruit should be completely dipped for 2-4 minutes	-
Ripe Fruit Spot – Post-Harvest (<i>Gloeosporium</i> spp.) Priority: Low							
Ripe Fruit Spot is a minor disease that has minimal impacts on banana quality. The appropriate and timely use of post-harvest fungicides is key to reducing disease incidence.							
Thiabendazole (Tecto) Syngenta	1	Protectant / Post-Harvest Dip	NR	A	NSW, WA	Registered in bananas for post-harvest control of Squirter Disease, Black-End Rot , Crown Rot and <i>Fusarium</i> , <i>Deighтониella</i> , <i>Verticillium</i> spp. After the bananas have passed through the de-handing and/or washing operation, the fruit should be completely dipped for 2-4 minutes	-
Banana Leaf Rust (<i>Uredo musae</i>) Priority: Low							
Rust is well established in major growing areas and is favoured by humid weather. It is usually controlled by fungicide programs used for other leaf diseases and specific management measures are not required.							
No Control Options Available							
Squirter – Post-Harvest (<i>Nigrospora musae</i> , <i>Nigrospora sphaerica</i>) Priority: Low							
Squirter is a minor disease. The appropriate and timely use of post-harvest fungicides is key to reducing disease incidence. The disease may be a problem in fully ripe fruit sent to interstate markets during winter or in chilled fruit that has undergone an extended ripening period.							
Thiabendazole (Tecto) Syngenta	1	Protectant / Post-Harvest Dip	NR	A	NSW, WA	Registered in bananas for post-harvest control of Squirter Disease , Black-End Rot, Crown Rot and <i>Fusarium</i> , <i>Deighтониella</i> , <i>Verticillium</i> spp. After the bananas have passed through the de-handing and/or washing operation, the fruit should be completely dipped for 2-4 minutes	-

4.2 Insects, mites and nematode pests of bananas

4.2.1 Insect, mite and nematode pest priorities

Common name	Scientific name
High	
Banana Weevil Borer	<i>Cosmopolites sordidus</i>
Banana Flower Thrips	<i>Thrips hawaiiensis</i>
Banana Rust Thrips	<i>Chaetanaphothrips signipennis</i>
Banana Scab Moth	<i>Nacoleia octasema</i>
Banana Spider Mite / Strawberry Spider Mite	<i>Tetranychus lambi</i>
Moderate	
Banana Spiral Nematode	<i>Helicotylenchus multicinctus</i>
Burrowing Nematode	<i>Radopholus similis</i>
Root-knot Nematode	<i>Meloidogyne</i> spp.
Reniform Nematode	<i>Rotylenchulus reniformis</i>
Sugarcane Bud Moth	<i>Opogona glycyphaga</i>
Banana Aphid ³	<i>Pentalonia nigronervosa</i>
Cane Grub / White Grub	<i>Lepidiota</i> spp.
Fall Armyworm	<i>Spodoptera frugiperda</i>
Low	
Two Spotted Mite	<i>Tetranychus urticae</i>
Banana Spotting Bug	<i>Amblypelta lutescens</i>
Fruit Spotting Bug	<i>Amblypelta nitida</i>
Banana Fruit Caterpillar	<i>Tiracola plagiata</i>
Banana-Silvering Thrips	<i>Hercinothrips bicinctus</i>
Cluster Caterpillar	<i>Spodoptera litura</i>
Queensland Fruit Fly	<i>Bactrocera tryoni</i>
Oriental Fruit Fly	<i>Bactrocera dorsalis</i>
Mealy Bugs	<i>Pseudococcus jackbeardsleyi</i>

The priorities identified for insects, mites and nematodes are similar to those detailed in the last SARP in 2014. Nematodes were listed separately in that report and while they continue to be a major issue in bananas they are seen as slightly less important than the major insect and mite pests. This is possibly because their impacts are less visual, and they tend to be controlled by the same control measures being used for pests such as Weevil Borer.

³ Vector for Banana Bunchy Top Virus and Banana Bract Mosaic Virus

There has been a slight shift in the relative importance of the different nematode species. Burrowing nematode has traditionally been the most significant and abundant type of nematode in bananas, particularly in the larger growing regions in North Qld. In recent times the Burrowing Nematode has become less dominant and the other species have increased in their incidence and importance.

The banana industry will continue to need a strategic, coordinated approach to managing the diverse insect, mite and nematode pests that impact on the crop.

4.2.2 Available and potential products for priority insect, mite and nematode pests

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

Availability		Regulatory risk (refer to Appendix 6)	
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 2018-19 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
Banana Weevil Borer (<i>Cosmopolites sordidus</i>)								
Priority: High								
Banana Weevil Borer can cause significant damage to bananas. Cultural controls such as using weevil-free planting material and general plantation hygiene play an important part of managing the pest. Insecticide options are generally older and disruptive chemistry. Insecticide resistance is a threat with the current options available.								
Bifenthrin (Talstar)	3A	Contact	1	A	QLD, NSW, WA & NT	Registered for control of Banana Weevil Borer , Banana Rust Thrips and Strawberry Spider Mite in bananas. Can be applied as a stool or band treatment. Apply either as a regular seasonal program (twice per year) or based on monitoring in traps.	VH Bee H	-
Cadusafos (Rugby)	1B	Contact	14	A	QLD	Registered for control of Burrowing Nematode, Root-Knot Nematode, Spiral Nematode and Banana Weevil Borer in bananas. Remove trash from base of stool and apply granules evenly to the soil surface in the area covered by a 30 cm radius around each stool. For best results apply just prior to irrigation or rainfall.	H Bee H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Chlorpyrifos (Lorsban)	1B	Contact	14	A	QLD, NSW	Registered for control of Banana Scab Moth, Banana Weevil Borer and Caterpillars in banana. After removing trash, apply spray to the lower 30 cm of the butt and to the surrounding soil within a radius of 30 cm, ensuring thorough coverage of butt and suckers.	H Bee H	R1
Clothianidin (Shield) Sumitomo	4A	Contact	NR	A	ALL	Registered for control of Weevil Borer and Rust Thrips in banana. Apply to the pseudostem of the main daughter plant when it is a height of 1.5m to the base of the central cigar leaf, preferably within 1 month of the bunch on the mother plant being harvested. Apply either by stem injection or stem spray.	M Bee VH	R2
Diazinon	1B	Contact	14	A	QLD	Registered for control of Banana Beetle Borer and Banana Rust Thrips in banana. Ensure good coverage of fingers and penetration inside bunch. Apply as required when the bunch is fully emerged until bracts have fallen. Apply every 14 days between Nov and Mar in Nth Qld.	H Bee H	R3
Fipronil (Regent)	2B	Contact & Ingestion	NR	A	QLD, NSW, WA & NT	Registered for control of Banana Rust Thrips and Banana Weevil Borer in banana. Apply in spring and/or autumn when weevil numbers reach or exceed acceptable threshold levels. Remove any green trash from the area to be treated and apply as a butt application to a height of 30cm and the soil/trash in a 30 cm radius from the stem base.	M Bee VH	-
Imidacloprid (Confidor Guard)	4A	Contact & Ingestion	NR	A	QLD, NSW, NT & WA	Registered for control of Banana Rust Thrips and Banana Weevil Borer in banana. Do not inject bunched plants. Select the best follower and inject into the base. Injection can occur any time within 3 months after harvest of the mother plant or nurse-suckering. Injection to plants smaller than 1.5 m tall may result in plant injury.	M Bee M	R2
Prothiofos (Tokuthion)	1B	Contact	NR	A	QLD, NSW, NT & WA	Registered for control of Banana Weevil Borer in banana. Apply as a base spray to the lower 30 cm of the butt and to the surrounding soil to a radius of 30cm. Apply at time of maximum weevil activity in spring or late summer/autumn. Can also be applied as a bait in harvested or fallen stools or as a stem injection in residual plants.	H Bee H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spirotetramat + Imidacloprid (Movento Energy) Bayer	23+4A	Contact & Ingestion	NR	A	QLD, NSW, NT & WA	Registered for control of Banana Rust Thrips and Banana Weevil Borer in banana. Do not treat plants after bell emergence. Select the best follower and inject into the base. Injection can occur any time within 3 months after harvest of the mother plant or nurse-suckering. To limit the risk of plant damage, inject only those followers that are at least 1 m tall to the throat of the plant.	M Bee M	R2
Terbufos (Counter)	1B	Contact	NR	A	ALL	Registered for control of Banana Weevil Borer and Burrowing Nematode in banana. Re-apply at 4 monthly intervals as required. Use a backpack granular applicator to apply to individual trees / followers or use a tractor granular applicator to apply a continuous band either side of the tree line.	H Bee H	R3
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		New diamide planned for registration in bananas.	L-M Bee L	-
Banana Flower Thrips (<i>Thrips hawaiiensis</i>) Priority: High								
Banana Flower Thrips are present in all growing regions. A range of predatory insects assist to reduce plant populations. The removal of the male "bell" where adult thrips move after all hands are exposed, may help in reducing thrips populations. Bunch injection treatments are recommended to reduce disruption of beneficial species that occurs with cover sprays.								
Acephate (Orthene)	1B	Contact	NR	A	QLD, NSW, WA & NT	Registered for control of Banana Scab Moth, Banana Flower Thrips and Banana Rust Thrips in banana. Apply as a bell injection. Inject directly into the upright bell as it emerges from the throat of the banana plant.	H Bee H	R3
Bifenthrin (Talstar 80SC)	3A	Contact	NR	A	QLD, NSW	Registered for control of Banana Scab Moth and Flower Thrips in bananas. Apply as a bell injection as it emerges from the throat of the banana plant while in the upright position. The correct site for injection is the top half to one third of the bell just below the distinct swelling where the male flower mass ends and the female flower cavity (bottom hand of fruit) start. Treat only when thrips are active. Treatments per season not limited.	VH Bee H	-
Fatty Acids – Potassium Salt (Natrasoap)		Contact	NR	A	ALL	Soft control option for control of aphids, thrips , mealybug, spider mite and whitefly in fruit. Use as a cover spray.	L Bee L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinetoram (Success Neo) Corteva PER87198	5	Contact & Ingestion	NR	A	NSW, NT, QLD & WA	Permitted for control of Banana Rust Thrips, Banana Flower Thrips and Flower-Eating Caterpillars in banana. DO NOT make more than 1 application per crop at bell emergence using a bell injector. Make the bell injection in the top half to one third of the emerging bell while the newly emerged bells are still upright. DO NOT make more than one application of spinetoram as a bunch spray following use as a bell injection.	M Bee VH	-
Fipronil (Regent)	2B	Contact & Ingestion	NR	P-A	QLD, NSW, WA & NT	Registered for control of Rust Thrips in banana. Apply at least 2 months prior to bunch emergence to reduce early thrips pressure. Apply as either a butt application to a height of 30 cm and the soil/trash in a 30 cm radius from the stem base, or as a 30 cm band along each plant row.	M Bee VH	-
<i>Beauveria bassiana</i> (Velifer) BASF	UN			P		Registered for suppression of Onion Thrips and Western Flower Thrips in protected vegetables and ornamentals. No MRLs required for a biological product.	L Bee L	-
SYNFOI21 Syngenta	New			P		Product in development. Bananas not currently in scope. Syngenta claim activity on thrips.		-
Banana Rust Thrips (<i>Chaetanaphothrips signipennis</i>) Priority: High								
Banana Rust Thrips are a major and frequent pest. They can have a major impact on fruit appearance which can lead to downgrading or rejection at market. Clean planting material and bunch covers can help along with general insect predators. Chemical control should be directed at both the soil-dwelling pupal stage and adults and larvae on the fruit and plant. Failure to control the pest at both sites will result in continual reinfestation.								
Acephate (Orthene)	1B	Contact	NR	A	QLD, NSW, WA & NT	Registered for control of Banana Scab Moth, Banana Flower Thrips and Banana Rust Thrips in banana. Apply as a bell injection. Inject directly into the upright bell as it emerges from the throat of the banana plant.	H Bee H	R3
Bifenthrin (Talstar)	3A	Contact	1	A	QLD, NSW, WA & NT	Registered for control of Banana Weevil Borer, Banana Rust Thrips and Strawberry Spider Mite in bananas. Can be applied as a stool or band treatment. Apply either as a regular seasonal program (twice per year) or based on monitoring in traps.	VH Bee H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Chlorpyrifos (Lorsban) PER14240	1B	Contact	14	A	NSW, QLD, NT & WA	Permitted for control of Sugar Cane Bud Moth, Banana Scab Moth, Banana Rust Thrips , Mealybugs and caterpillars in banana. Apply as a dust to the inside of the bunch cover and the fruit. Mix product with a talc and ensure dusting occurs within 1 week of bunch covering. Apply one application only.	H Bee H	R1
Clothianidin (Shield) Sumitomo	4A	Contact	NR	A	ALL	Registered for control of Weevil Borer and Rust Thrips in banana. Apply to the pseudostem of the main daughter plant when it is a height of 1.5 m to the base of the central cigar leaf, preferably within 1 month of the bunch on the mother plant being harvested. Apply either by stem injection or stem spray.	M Bee VH	R2
Diazinon	1B	Contact	14	A	QLD	Registered for control of Banana Beetle Borer and Banana Rust Thrips in banana. Ensure good coverage of fingers and penetration inside bunch. Apply as required when the bunch is fully emerged until bracts have fallen. Apply every 14 days between Nov and Mar in Nth Qld.	H Bee H	R3
Fatty Acids – Potassium Salt (Natrasoap)		Contact	NR	A	ALL	Soft control option for control of aphids, thrips , mealybug, spider mite and whitefly in fruit. Use as a cover spray.	L Bee L	-
Fipronil (Regent)	2B	Contact & Ingestion	NR	A	QLD, NSW, WA & NT	Registered for control of Banana Rust Thrips and Banana Weevil Borer in banana. Apply at least 2 months prior to bunch emergence to reduce early thrips pressure. Apply as either a butt application to a height of 30 cm and the soil/trash in a 30 cm radius from the stem base, or as a 30 cm band along each plant row.	M Bee VH	-
Imidacloprid (Confidor Guard)	4A	Contact & Ingestion	NR	A	NTH QLD, NT & NTH WA	Registered for control of Banana Rust Thrips and Banana Weevil Borer in banana. Do not inject bunched plants. Select the best follower and inject into the base. Injection can occur any time within 3 months after harvest of the mother plant or nurse-suckering. Injection to plants smaller than 1.5 m tall may result in plant injury. Registered only on Cavendish variety.	M Bee M	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinetoram (Success Neo) Corteva	5	Contact & Ingestion	NR	A	ALL	Registered for control of Banana Rust Thrips and Sugarcane Bud Moth. Apply as a bunch spray ensuring complete coverage of the bunch. Application should be made no later than 2 weeks after bunch emergence and immediately after placement of the bunch cover. DO NOT make more than 2 applications per crop.	M Bee VH	-
Spinetoram (Success Neo) Corteva PER87198	5	Contact & Ingestion	NR	A	NSW, NT, QLD & WA	Permitted for control of Banana Rust Thrips , Banana Flower Thrips and Flower Eating Caterpillars such as Sugarcane Bud Moth and Scab Moth. DO NOT make more than 1 application per crop at bell emergence using a bell injector. Make the bell injection in the top half to one third of the emerging bell while the newly emerged bells are still upright. DO NOT make more than one application of spinetoram as a bunch spray following use as a bell injection.	M Bee VH	-
Spirotetramat + Imidacloprid (Movento Energy) Bayer	23+4A	Contact & Ingestion	NR	A	QLD, NSW, NT & WA	Registered for control of Banana Rust Thrips and Banana Weevil Borer in banana. Do not treat plants after bell emergence. Select the best follower and inject into the base. Injection can occur any time within 3 months after harvest of the mother plant or nurse-suckering. To limit the risk of plant damage, inject only those followers that are at least 1 m tall to the throat of the plant.	M Bee M	R2
<i>Beauveria bassiana</i> (Velifer) BASF	UN			P		Registered for suppression of Onion Thrips and Western Flower Thrips in protected vegetables and ornamentals. No MRLs required for a biological product.	L Bee L	-
Spinosad (Entrust Organic) Corteva	5	Contact & Ingestion		P		Registration pending in bananas for control of Banana Rust Thrips.	M Bee VH	-
SYNFOI21 Syngenta	New			P		Product in development. Bananas not currently in scope. Syngenta claim activity on thrips.		-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Banana Scab Moth (<i>Nacoleia octasema</i>) Priority: High								
Found only in Nth Qld, north of Ingham. Banana Scab Moth is a major and frequent pest and the larvae cause superficial scarring on young fruit. Damaged areas form a black callous, rendering the fruit unmarketable. Careful selection of following suckers of equal size ensures concentrated bunching cycle to streamline control and a range of spiders and general predators assist in managing the pest. Bunch injection is recommended to promote biological control. Injection must be carried out when the bunch is still upright in the throat of the plant.								
Acephate (Orthene)	1B	Contact	NR	A	QLD, NSW, WA & NT	Registered for control of Banana Scab Moth , Banana Flower Thrips and Banana Rust Thrips in banana. Apply as a bell injection. Inject directly into the upright bell as it emerges from the throat of the banana plant.	H Bee H	R3
Bifenthrin (Talstar 80SC)	3A	Contact	NR	A	QLD, NSW	Registered for control of Banana Scab Moth and Flower Thrips in bananas. Apply as a bell injection as it emerges from the throat of the banana plant while in the upright position. The correct site for injection is the top half to one third of the bell just below the distinct swelling where the male flower mass ends and the female flower cavity (bottom hand of fruit) start. Treatments per season not limited.	VH Bee H	-
Chlorpyrifos (Lorsban)	1B	Contact	14	A	QLD, NSW	Registered for control of Banana Scab Moth , Banana Weevil Borer and Caterpillars in banana. Apply as a cover spray from the first appearance of flower bell and repeat as populations indicate until fingers are exposed. Burning of young fruit may occur under poor drying conditions.	H Bee H	R1
Chlorpyrifos (Lorsban) PER14240	1B	Contact	14	A	NSW, QLD, NT & WA	Permitted for control of Sugar Cane Bud Moth, Banana Scab Moth , Banana Rust Thrips, Mealybugs and caterpillars in banana. Apply as a dust to the inside of the bunch cover and the fruit. Mix product with a talc and ensure dusting occurs within 1 week of bunch covering. Apply one application only.	H Bee H	R1
Spinetoram (Success Neo) Corteva PER87198	5	Contact & Ingestion	NR	A	NSW, NT, QLD & WA	Permitted for control of Banana Rust Thrips, Banana Flower Thrips and Flower Eating Caterpillars such as Sugarcane Bud Moth and Scab Moth . DO NOT make more than 1 application per crop at bell emergence using a bell injector. Make the bell injection in the top half to one third of the emerging bell while the newly emerged bells are still upright. DO NOT make more than one application of spinetoram as a bunch spray following use as a bell injection.	M Bee VH	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
NUL3445 Nufarm	TBC			P		New active in development, with bananas currently in scope. Nufarm claim activity on lepidoptera.		-
Spinetoram (Success Neo) Corteva	5	Ingestion		P		Corteva planning label extension for control of Banana Scab Moth.	M Bee VH	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		New diamide planned for registration in bananas.	L-M Bee L	-
Banana Spider Mite / Strawberry Spider Mite (<i>Tetranychus lambi</i>)								
Priority: High								
Widely distributed in all growing regions, activity is mainly confined to dry spring and summer periods. Severe outbreaks are usually associated with the use of cover sprays of broad-spectrum insecticides. Controlling dust and general plantation hygiene are important cultural controls. There are several predatory insects that feed on mite populations so limiting the use of disruptive insecticides will assist with biological control.								
Bifenthrin (Talstar)	3A	Contact	1	A	QLD, NSW, WA & NT	Registered for control of Banana Weevil Borer, Banana Rust Thrips and Strawberry Spider Mite in bananas. Apply as a preventative treatment before damage occurs, and before mite numbers build up to damaging levels. Follow up applications may be required at 10-14 day intervals.	VH Bee H	-
Clofentozine (Apollo)	10A	IGR / Contact	NR	A	QLD, NSW & WA	Registered for control of Two-Spotted Mite and Strawberry Spider Mite in banana. Apply when mites first appear. Apply a registered knockdown miticide for subsequent applications.	L Bee L	-
Dicofol (Miti-Fol)	2B	Ingestion	7	A	QLD	Registered for control of Two-Spotted Mite and Strawberry Spider Mite in banana. Apply at first appearance of mites (as shown by russetting along the veins) and repeat as necessary.	M Bee L	R1
Ethyl Formate (Vapormate)		Post-Harvest Fumigation	NR	A	ALL	Registered for post-harvest control of mites , mealybugs, scale and coffee bean weevil in banana. Requires 6 hours of exposure in an enclosed chamber or box with a sealed plastic bag inside, at a temperature greater than 15 degrees Celsius. Users must be trained under a BOC approved training program.		-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Etoxazole (Paramite)	10B	IGR / Contact	1	A	ALL	Registered for control of Strawberry Spider Mite in banana. Apply at the first signs of an increase in the population of mite crawlers. Once large numbers of adults are present it may be necessary to also apply a miticide from a different group to control the adults immediately and reduce the potential damage.	L Bee VL	-
Fenbutatin Oxide (Torque)	12A	Contact	1	A	QLD, NSW & NT	Registered for control of Two-Spotted Mite and Banana Spider Mite in banana. Apply according to pest incidence, well before a dense infestation develops. Repeat as required.	L Bee L	R2
Fatty Acids – Potassium Salt (Natrasoap)		Contact	NR	A	ALL	Soft control option for control of aphids, thrips, mealybug, spider mite and whitefly in fruit. Use as a cover spray.	L Bee L	-
Pyridaben (Sanmite)	21A	IGR / Contact	1	A	QLD, NSW, WA & NT	Registered for control of Strawberry Spider Mite and Two-Spotted Mite in banana. Apply when mite populations persist at a high level and damage to sensitive parts such as spearpoint suckers is evident.	H Bee H	-
Sulfur PER9409	UN	Contact	NR	A	NSW, QLD	Permitted for control of mites in banana. Apply using duster shortly after bell emergence. Apply dust evenly to avoid heavy localised deposits which will result in unwanted visual residues of sulfur. Application is to be confined to fruit, avoiding leaves as much as possible as sulfur deposits will interfere with beneficial insect activity.	M-H Bee H	-
Propargite (Omite)	12C	Contact	7	P-A	QLD, NSW, ACT & WA	Registered for control of Two-Spotted Mite in banana. Spray when bunches covered and pests appear and repeat as necessary. Avoid spraying under hot-humid-slow drying conditions when young bananas may be susceptible to insecticide damage.	M Bee L	R3
<i>Beauveria bassiana</i> (Velifer) BASF	UN	Ingestion		P		Biological currently registered in protected vegetables and ornamentals, with activity on mites. No MRLs required for biological product.	L Bee L	-
Bifenazate (Acramite) Arysta	20D	Contact & Ingestion		P		Registered for mite control in various crops. No MRLs in place for AU or Codex.	L Bee H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spiromesifen (Oberon) Bayer	23	Ingestion		P		No current registration in AU	M Bee VL	-
<p>Banana Spiral Nematode (<i>Helicotylenchus multicinctus</i>), Burrowing Nematode (<i>Radopholus similis</i>), Root-Knot Nematode (<i>Meloidogyne spp.</i>), Reniform Nematode (<i>Rotylenchulus reniformis</i>)</p> <p>Priority: Moderate</p> <p>The Spiral Nematode is widespread in all banana producing areas. The Burrowing Nematode has been the most common and damaging nematode of bananas, although there has been a shift away from it being the dominant species in banana plantations. It is only found in east coast regions. The Root-Knot Nematode is widespread and abundant in all banana growing regions. The Reniform Nematode is abundant in Nth Qld but is not thought to be in other growing regions. The banana industry has been successful in reducing the need for nematicides used through crop rotation and soil health management.</p>								
Cadusafos (Rugby)	1B	Contact	14	A	NSW, WA	Registered for control of Burrowing Nematode, Root-Knot Nematode, Spiral Nematode and Banana Weevil Borer in bananas. Remove trash from base of stool and apply granules evenly to the soil surface in the area covered by a 30 cm radius around each stool. For best results apply just prior to irrigation or rainfall.	H Bee H	-
Terbufos (Counter)	1B	Contact	NR	A	ALL	Registered for control of Banana Weevil Borer and Burrowing Nematode in banana. Re-apply at 4 monthly intervals as required. Use a backpack granular applicator to apply to individual trees / followers or use a tractor granular applicator to apply a continuous band either side of the tree line.	H Bee H	R3
Fluazaindolizine (Reklemel, Salibro) Corteva	New			P		Development underway in AU, to be launched globally in 2021. New MOA nematicide.		-
Fluopyram (Velum Prime) Bayer	7			P		Registration pending in AU in various crops. AU MRL 0.1 mg/kg. Codex MRL 0.8 mg/kg.		-
NUL3145 Nufarm	TBC			P		New nematicide in development from Nufarm.		-
SYNSTN1 Syngenta	TBC			P		New nematicide in development from Syngenta.		-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Sugarcane Bud Moth (<i>Opogona glycyphaga</i>)								
Priority: Moderate								
Sugarcane Bud Moth causes damage to bananas in all growing regions. Larvae cause superficial damage to the fruit by feeding in the surface of the fruit after the bracts have fallen. The application of an insecticide when the bunch covers are applied will protect the fruit from damage.								
Chlorpyrifos (Lorsban) PER14240	1B	Contact	14	A	NSW, QLD, NT & WA	Permitted for control of Sugar Cane Bud Moth , Banana Scab Moth, Banana Rust Thrips, Mealybugs and caterpillars in banana. Apply as a dust to the inside of the bunch cover and the fruit. Mix product with a talc and ensure dusting occurs within 1 week of bunch covering. Apply one application only.	H Bee H	R1
Spinetoram (Success Neo) Corteva	5	Contact & Ingestion	NR	A	ALL	Registered in bananas for the control of Banana rust thrips and Sugarcane bud moth . Apply as a bunch spray ensuring complete coverage of the bunch. Application should be made no later than 2 weeks after bunch emergence and immediately after placement of the bunch cover. DO NOT make more than 2 applications per crop.	M Bee VH	-
Spinetoram (Success Neo) Corteva PER87198	5	Contact & Ingestion	NR	A	NSW, NT, QLD & WA	Permit is in place to cover bell injection for various pests such as Banana rust thrips, Banana flower thrips, Flower eating caterpillars such as Sugarcane bud moth and Scab Moth. DO NOT make more than 1 application per crop at bell emergence using a bell injector. Make the bell injection in the top half to one third of the emerging bell while the newly emerged bells are still upright. DO NOT make more than one application of spinetoram as a bunch spray following use as a bell injection.	M Bee VH	-
NUL3445 Nufarm	TBC			P		New active in development, with bananas currently in scope. Nufarm claim activity on lepidoptera.		-
Spinosad (Entrust Organic) Corteva	5	Ingestion		P		Label registration pending	L Bee H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Banana Aphid (<i>Pentalonia nigronervosa</i>) Priority: Moderate								
Banana Aphid is a minor and frequent pest in northern Qld where bunchy top does not occur. It is a more serious pest in south-east Qld because it is a vector of bunchy top disease. Chemical control of aphids is not effective for bunchy top control and direct damage is seldom severe enough to warrant treatment.								
Fatty Acids – Potassium Salt (Natrasoap)		Contact	NR	A	ALL	Soft control option for control of aphids , thrips, mealybug, spider mite and whitefly in fruit. Use as a cover spray	L Bee L	-
Imidacloprid (Confidor Guard) + Paraffinic Oil PER14850	4A	Ingestion	NR NG	A	ALL	Permitted for control of susceptible disease vectors, including Banana Aphid , on plants that have been treated with glyphosate, as per the conditions of this permit. Inject mixture into pseudostem above the growing point. Where bunches are present, spray the surface of fruit with red marker dye. No fruit from treated plants can be sold or consumed. Imidacloprid injection and paraffinic oil foliar sprays should be used together for control of Banana Aphid.	M Bee M	R2
Spirotetramat + Imidacloprid (Movento Energy) Bayer PER88359	23+4A	Contact & Ingestion	NR	A	QLD, NSW, NT & WA	Permitted for control of Banana Aphid in banana. Do not use more than 1 application per crop. Do not treat plants after bell emergence. Do not inject into the centre of the plant to avoid plant death. Treatment can occur at any time within 3 months after harvest of the mother plant or nurse-suckering. Treat using a trunk injector. To limit the risk of plant damage, inject only those followers that are at least 1 m tall to the throat of the plant.	M Bee M	R2
Afidopyropen (Versys) BASF	9D	Ingestion		P		Registered for control of aphids in various crops. Hort Innovation ST18001 Grant funded project underway to support a label extension with BASF. Due for completion 2023. AU MRL 0.02 mg/kg. No Codex MRL.	L Bee L	-
<i>Beauveria bassiana</i> (Velifer) BASF	UN	Biological		P		Registered for suppression of aphids in protected vegetables and ornamentals. No MRLs required.		-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Cane Grub / White Grub (<i>Lepidiota spp</i>)								
Priority: Moderate								
Cane Grub larvae can cause damage to banana roots in early summer. This can lead to plant lodging under heavy pest pressure. Damage is similar to that caused by nematodes or Banana Weevil Borer. There are no chemical controls available, but it is likely that treatments for Banana Weevil Borer will keep Cane Grub in check.								
Bifenthrin (Talstar)	3A	Contact	1	P-A	Qld, NSW, WA, NT	Registered for control of Banana Weevil Borer, Banana Rust Thrips and Strawberry Spider Mite in bananas. Can be applied as a stool or band treatment. Apply either as a regular seasonal program (twice per year) or based on monitoring in traps.	VH Bee H	-
Cadusafos (Rugby)	1B	Contact	14	P-A	Qld	Registered for control of Burrowing Nematode, Root-Knot Nematode, Spiral Nematode and Banana Weevil Borer in bananas. Remove trash from base of stool and apply granules evenly to the soil surface in the area covered by a 30 cm radius around each stool. For best results apply just prior to irrigation or rainfall.	H Bee H	-
NUL3145 Nufarm	TBC			P		New product in development. Bananas are in scope. Nufarm claim activity on various beetles.		-
NUL3445 Nufarm	TBC			P		New active in development, with bananas currently in scope. Nufarm claim activity on beetles.		-
SYNFOI21 Syngenta	TBC			P		Product in development. Bananas not currently in scope. Syngenta claim activity on beetles.		-
Fall Armyworm (<i>Spodoptera frugiperda</i>)								
Priority: Moderate								
Fall Armyworm has recently been detected in northern Australia, although not yet seen in bananas. Suspected detections should be reported to Biosecurity Agencies immediately.								
Spinetoram (Success Neo) Corteva PER89241	5	Ingestion	NR	A	ALL	Permitted for control of Fall Armyworm in bananas. Treat when pests appear, targeting eggs at hatch or small larvae (prior to third instar stage) before the pest becomes entrenched. DO NOT make more than 2 applications per crop.	M Bee VH	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Emamectin (Proclaim) Syngenta	6	Ingestion		P		Registered for control of Spodoptera in various crops. No MRLs in place for AU or Codex.	M Bee H	-
Indoxacarb (Avatar) FMC	22A	Ingestion		P		Registered for control of Spodoptera in various crops. No MRLs in place for AU or Codex.	M Bee H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion		P		Label registration pending	L Bee H	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Pending Australian Registration	L-M Bee L	-
Two Spotted Mite (<i>Tetranychus urticae</i>)								
Priority: Low								
Can cause similar damage as Banana Spider Mites but their incidence in damaging numbers is much less frequent. Severe outbreaks are usually associated with the use of cover sprays of broad-spectrum insecticides. Controlling dust and general plantation hygiene are important cultural controls. There are several predatory insects that feed on mite populations so limiting the use of disruptive insecticides will assist with biological control.								
Clofentozine (Apollo)	10A	IGR / Contact	NR	A	QLD, NSW & WA	Registered for control of Two-Spotted Mite and Strawberry Spider Mite in banana. Apply when mites first appear. Apply a registered knockdown miticide for subsequent applications.	L Bee L	-
Dicofol (Miti-Fol)	2B	Ingestion	7	A	QLD	Registered for control of Two-Spotted Mite and Strawberry Spider Mite in banana. Apply at first appearance of mites (as shown by russeting along the veins) and repeat as necessary.	M Bee L	R1
Ethyl Formate (Vapormate)		Post-Harvest Fumigation	NR	A	ALL	Registered for post-harvest control of mites , mealybugs, scale and coffee bean weevil in banana. Requires 6 hours of exposure in an enclosed chamber or box with a sealed plastic bag inside, at a temperature greater than 15 degrees Celsius. Users must be trained under a BOC approved training program.		-
Fenbutatin Oxide (Torque)	12A	Contact	1	A	QLD, NSW & NT	Registered for control of Two-Spotted Mite and Banana Spider Mite in banana. Apply according to pest incidence, well before a dense infestation develops. Repeat as required.	L Bee L	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Fatty Acids – Potassium Salt (Natrasoap)		Contact	NR	A	ALL	Soft control option for control of aphids, thrips, mealybug, spider mite and whitefly in fruit. Use as a cover spray.	L Bee L	-
Propargite (Omite)	12C	Contact	7	A	QLD, NSW, ACT & WA	Registered for control of Two-Spotted Mite in banana. Spray when bunches covered and pests appear and repeat as necessary. Avoid spraying under hot-humid-slow drying conditions when young bananas may be susceptible to insecticide damage.	M Bee L	R3
Pyridaben (Sanmite)	21A	IGR / Contact	1	A	QLD, NSW, WA & NT	Registered for control of Strawberry Mite and Two-Spotted Mite in banana. Apply when mite populations persist at a high level and damage to sensitive parts such as spearpoint suckers is evident.	H Bee H	-
Sulfur PER9409	UN	Contact	NR	A	NSW, QLD	Permitted for control of mites in banana. Apply using duster shortly after bell emergence. Apply dust evenly to avoid heavy localised deposits which will result in unwanted visual residues of sulphur. Application is to be confined to fruit, avoiding leaves as much as possible as sulphur deposits will interfere with beneficial insect activity.	M-H Bee H	-
Bifenthrin (Talstar)	3A	Contact	1	P-A	QLD, NSW, WA & NT	Registered for control of Banana Weevil Borer, Banana Rust Thrips and Strawberry Spider Mite in bananas. Apply as a preventative treatment before damage occurs, and before mite numbers build up to damaging levels. Follow up applications may be required at 10-14 day intervals.	VH Bee H	-
Etoxazole (Paramite)	10B	IGR / Contact	1	P-A	ALL	Registered for control of Strawberry Mite in banana. Apply at the first signs of an increase in the population of mite crawlers. Once large numbers of adults are present it may be necessary to also apply a miticide from a different group to control the adults immediately and reduce the potential damage.	L Bee VL	-
<i>Beauveria bassiana</i> (Velifer) BASF	UN	Ingestion		P		Biological currently registered in protected vegetables and ornamentals, with activity on mites. No MRLs required for biological product.	L Bee L	-
Bifenazate (Acramite) Arysta	20D	Contact & Ingestion		P		Registered for mite control in various crops. No MRLs in place for AU or Codex.	L Bee H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Banana Spotting Bug, Fruit Spotting Bug (<i>Amblypelta lutescens</i> , <i>Amblypelta nitida</i>)								
Priority: Low								
Bananas are not a preferred host for spotting bugs, but they will damage fruit if there are no other crops in the vicinity. They may cause small fruit to shed and in larger fruit they cause superficial dimples on the surface, similar to that caused by Fruit Fly. No chemical options are registered but broad spectrum insecticides would provide incidental control.								
Flupyradifurone (Sivanto Prime) Bayer	4D	Ingestion		P		Registered for control of Spotting Bugs in macadamia. No MRLs for AU or Codex.	L Bee L	-
SYNFOI21 Syngenta	New			P		New active in development with activity on bugs.		-
Banana Fruit Caterpillar (<i>Tiracola plagiata</i>)								
Priority: Low								
Minor and sporadic pest, Banana Fruit Caterpillar are only ever a problem in South-East Qld. They usually only attack bunches on the edges of a plantation. They can cause substantial fruit damage because of their size.								
Chlorpyrifos (Lorsban)	1B	Contact	14	A	QLD, NSW	Registered for control of Banana Scab Moth, Banana Weevil Borer and Caterpillars . Apply as a cover spray from the first appearance of flower bell and repeat as populations indicate until fingers are exposed. Burning of young fruit may occur under poor drying conditions.	H Bee H	R1
Chlorpyrifos (Lorsban) PER14240	1B	Contact	14	A	NSW, QLD, NT, WA	Permitted for control of Sugar Cane Bud Moth, Banana Scab Moth, Banana Rust Thrips, Mealy Bugs and Caterpillars . Apply as a dust to the inside of the bunch cover and the fruit. Mix product with a talc and ensure dusting occurs within 1 week of bunch covering. Apply one application only.	H Bee H	R1
Spinetoram (Success Neo) Corteva	5	Contact & Ingestion	NR	P-A	ALL	Registered for control of Banana Rust Thrips and Sugar Cane Bud Moth in bananas. Apply as a bunch spray ensuring complete coverage of the bunch. Application should be made no later than 2 weeks after bunch emergence and immediately after placement of the bunch cover. DO NOT make more than 2 applications per crop.	M Bee VH	-
NUL3445 Nufarm	TBC			P		New active in development, with bananas currently in scope. Nufarm claim activity on lepidoptera.		-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Banana Silvering Thrips (<i>Hercinothrips bicinctus</i>)								
Priority: Low								
A minor and infrequent pest in Southern Qld and Northern NSW. Causes minor superficial damage to the fruit.								
Fatty Acids – Potassium Salt (Natrasoap)		Contact	NR	A	ALL	Soft control option for control of aphids, thrips , mealybug, spider mite and whitefly in fruit. Use as a cover spray.	L Bee L	
Cluster Caterpillar (<i>Spodoptera litura</i>)								
Priority: Low								
Minor and infrequent pest that mostly attacks the leaves of the plant and not the fruit. Close monitoring is important to ensure that it is not confused with the Fall Armyworm which is potentially more damaging to fruit.								
Chlorpyrifos (Lorsban)	1B	Contact	14	A	QLD, NSW	Registered for control of Banana Scab Moth, Banana Weevil Borer and Caterpillars . Apply as a cover spray from the first appearance of flower bell and repeat as populations indicate until fingers are exposed. Burning of young fruit may occur under poor drying conditions.	H Bee H	R1
Chlorpyrifos (Lorsban) PER14240	1B	Contact	14	A	NSW, QLD, NT & WA	Permitted for control of Sugar Cane Bud Moth, Banana Scab Moth, Banana Rust Thrips, Mealybugs and Caterpillars . Apply as a dust to the inside of the bunch cover and the fruit. Mix product with a talc and ensure dusting occurs within 1 week of bunch covering. Apply one application only.	H Bee H	R1
Spinetoram (Success Neo) Corteva	5	Contact & Ingestion	NR	P-A	ALL	Registered for Banana Rust Thrips and Sugar Cane Bud Moth in bananas, and Flower-Eating Caterpillars, Leafrollers & Loopers, Yellow Peach Moth, Red-Banded Thrips and Sorghum Head Caterpillar in banana. Apply as a bunch spray ensuring complete coverage of the bunch. Application should be made no later than 2 weeks after bunch emergence and immediately after placement of the bunch cover. DO NOT make more than 2 applications per crop.	M Bee VH	-
Emamectin (Proclaim) Syngenta	6	Ingestion		P		Registered for control of Spodoptera in various crops. No MRLs in place for AU or Codex.	M Bee H	-
Indoxacarb (Avatar) FMC	22A	Ingestion		P		Registered for control of Spodoptera in various crops. No MRLs in place for AU or Codex.	M Bee H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinosad (Entrust Organic) Corteva	5	Ingestion		P		Registration pending for use in organic crops, including bananas.	L Bee H	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		New diamide planned for registration in bananas.	L-M Bee L	-
Fruit Flies, including Queensland Fruit Fly (<i>Bactrocera tryoni</i>), Oriental Fruit Fly (<i>Bactrocera dorsalis</i>), Lesser Qld Fruit Fly (<i>Bactrocera neohumeralis</i>), Darwin Fruit Fly (<i>Bactrocera aquilonis</i>), Mediterranean Fruit Fly (<i>Ceratitis capitata</i>) Priority: Low Queensland Fruit Fly is a pest of a wide range of horticultural crops in Qld, but only rarely damages banana. In-crop control measures are unlikely to be required. Post-harvest treatments are required for fruit sent interstate or exported.								
Dimethoate	1B	Contact / Post-Harvest Dip	NR	A	NSW, WA & QLD	Registered as a post-harvest dip for control of Fruit Fly and Qld Fruit Fly . Dip the fruit for 1 minute.	H Bee H	R1
Dimethoate PER87164	1B	Contact / Post-Harvest	NR	A	ALL	Permitted as a Post-Harvest Dip for control of Lesser Qld Fruit Fly, Darwin Fruit Fly and Mediterranean Fly and as a Floodspray for control of Qld Fruit Fly, Lesser Qld Fruit Fly, Darwin Fruit Fly and Mediterranean Fly in banana. For dipping, immerse the fruit for 1 minute. Floodspray treatment must provide complete coverage of the fruit for a minimum of 10 seconds after which the fruit must remain wet for not less than 60 seconds.	H Bee H	R1
Mealybugs (<i>Pseudococcus jackbeardsleyi</i>) Priority: Low Minor and infrequent pest.								
Chlorpyrifos (Lorsban) PER14240	1B	Contact	14	A	NSW, QLD, NT & WA	Permitted for control of Sugar Cane Bud Moth, Banana Scab Moth, Banana Rust Thrips, Mealybugs and Caterpillars. Apply as a dust to the inside of the bunch cover and the fruit. Mix product with a talc and ensure dusting occurs within 1 week of bunch covering. Apply one application only.	H Bee H	R1

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Ethyl Formate (Vapormate)		Post-Harvest Fumigation	NR	A	ALL	Registered for post-harvest control of mites, mealybugs , scale and coffee bean weevil in banana. Requires 6 hours of exposure in an enclosed chamber or box with a sealed plastic bag inside, at a temperature greater than 15 degrees Celsius. Users must be trained under a BOC approved training program.		-
Fatty Acids – Potassium Salt (Natrasoap)		Contact	NR	A	ALL	Soft control option for control of aphids, thrips, mealybug , spider mite and whitefly in fruit. Use as a cover spray.	L Bee L	-

4.3 Weeds in bananas

4.3.1 Weed priorities

Common Name	Scientific Name
High	
Canadian Fleabane	<i>Conyza canadensis</i>
Moderate	
Navua sedge	<i>Cyperus spp</i>
Nutgrass	<i>Cyperus rotundus</i>
Feathertop Rhodes Grass	<i>Chloris virgata</i>
Crowsfoot Grass	<i>Eleusine indica</i>

Canadian Fleabane has been identified as a high priority weeds in bananas. Navua Sedge, Nutgrass, Feathertop Rhodes Grass and Crowsfoot Grass are of moderate priority.

Resistance management

Of the weeds listed in the table above, there are confirmed cases of resistance in Australia for Feather Top Rhodes Grass (Group M).

Specific resistance management strategies for high resistance risk (A and B) and moderate resistance risk (C, D, F, G, I, J, K, L, M, N, Q and Z) herbicide modes of action are available on the CropLife Australia webpage.

<https://www.croplife.org.au/resources/programs/resistance-management/herbicide-resistance-management-strategies-2/>

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 6)	
		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
Canadian Fleabane (<i>Conyza canadiensis</i>)							
Priority: High							
A frequent weed in banana plantations with herbicide options such as glyphosate and paraquat usually ineffective. If possible, remove and destroy plants prior to setting seed, either by mechanical means or slashing.							
No Options Available							
Navua Sedge (<i>Cyperus spp</i>), Nutgrass (<i>Cyperus rotundus</i>)							
Priority: Moderate							
Navua Sedge and Nutgrass compete strongly with inter-row grasses and are difficult to control with herbicides. Improving soil drainage can help in reducing the incidence but this may not be practical. Strategic use of glyphosate using a wick wiper can be effective but is labour intensive.							
Glyphosate (Roundup)	M**	Banana / Directed Spray, Shielded Spray or Wick Wiper	Registered in bananas for control of various Grass and Broadleaf Weeds and Nutgrass . Time application when weeds are flowering. Repeat applications will be necessary.	NR	A	ALL	R3

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory Risk
Feathertop Rhodes Grass (<i>Chloris virgata</i>)							
Priority: Moderate							
There are confirmed cases of resistance in Australia for Feather top Rhodes grass (Group M at 4 sites) Feathertop Rhodes is becoming more widespread and is difficult to control with broadspectrum herbicides. A single application of a knockdown herbicide will usually be inadequate to achieve control. Pre-emergent herbicides are generally more reliable but not always practical to use in a plantation.							
2,2-DPA	J**	Bananas / Directed Spray	Registered in bananas for control of annual grasses and perennial grasses. Do not apply to plants, especially suckers. Do not spray if soil wet or storm, rains likely.	7	A	NSW, QLD	-
Fluazifop – P (Fusilade)	A***	Banana / Directed Spray	Registered in bananas for control of various grass weeds, including Rhodes Grass . Direct the spray to the base of the tree. Repeat sprays may be necessary if grass is more advanced.	NR	A	NSW, QLD, NT & WA	-
Glyphosate (Roundup)	M**	Banana / Directed Spray, Shielded Spray or Wick Wiper	Registered in bananas for control of various grass and broadleaf weeds, including Rhodes Grass . Apply when weeds are actively growing.	NR	A	ALL	R3
Haloxyfop (Verdict)	A***	Banana / Directed Spray or Spot Spray	Registered in bananas for control of various grass weeds in including Rhodes Grass . Spray should be directed to the base of the tree avoiding contact with fruit and foliage.	NR	A	ALL	-
Paraquat (Gramoxone)	L**	Orchards / Directed Spray	Registered in bananas for control of annual grass weeds and annual broadleaf weeds. Avoid contacting crop foliage. Apply soon after weed emergence and before weeds reach 15cm in height.	H:NR G:1	A	QLD, VIC, TAS, SA, WA & NT	R3
Pendimethalin (Stomp)	D**	Banana / Directed Spray, Requires Incorporation	Registered in bananas for control of various grass and broadleaf weeds. Use a directed spray avoiding spray contact with green bank, fruit and foliage. Requires incorporation by mechanical means or rainfall/irrigation within 10 days of application.	NR	P-A	ALL	-

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory Risk
Crowsfoot Grass (<i>Eleusine indica</i>)							
Priority: Moderate							
Requires a strategic approach to control, as with Feathertop Rhodes Grass. Double knock techniques and the use of residual herbicides will assist.							
2,2-DPA	J**	Bananas / Directed Spray	Registered in bananas for control of annual grasses and perennial grasses. Do not apply to plants, especially suckers. Do not spray if soil wet or storm, rains likely.	7	A	NSW, QLD	-
Fluazifop – P (Fusilade)	A***	Banana / Directed Spray	Registered in bananas for control of various grass weeds, including Crowsfoot Grass . Direct the spray to the base of the tree. Repeat sprays may be necessary if grass is more advanced.	NR	A	NSW, QLD, NT & WA	-
Glyphosate present as Potassium Salt (Touchdown HiTech)	M**	Orchards / Directed Spray, Shielded Spray or Wick Wiper	Registered in orchards for control of various grass and broadleaf weeds, including Crowsfoot Grass . Apply when weeds are actively growing.	NR	A	ALL	R3
Haloxyfop (Verdict)	A***	Orchards / Directed Spray or Spot Spray	Registered in orchards for control of various grass weeds including Crowsfoot Grass . Spray should be directed to the base of the tree avoiding contact with fruit and foliage.	NR	A	ALL	-
Pendimethalin (Stomp)	D**	Banana / Directed Spray, Requires Incorporation	Registered in bananas for control of various grass and broadleaf weeds including Crowsfoot Grass . Use a directed spray avoiding spray contact with green bank, fruit and foliage. Requires incorporation by mechanical means or rainfall/irrigation within 10 days of application.	NR	A	ALL	-
Paraquat (Gramoxone)	L**	Orchards / Directed Spray	Registered in bananas for control of annual grass weeds and annual broadleaf weeds. Avoid contacting crop foliage. Apply soon after weed emergence and before weeds reach 15cm in height.	H:NR G:1	A	QLD, VIC, TAS, SA, WA & NT	R3

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory Risk
Grass and Broadleaf Weeds							
Priority: Low							
There are several herbicides registered for use in bananas to assist the use of cultural controls such as ground cover, mulch, etc in plantations.							
2,2-DPA	J**	Bananas / Directed Spray	Registered in bananas for control of annual and perennial grass weeds . Do not apply to plants, especially suckers. Do not spray if soil wet or storm, rains likely.	7	A	NSW, QLD	-
Diuron	C**	Bananas / Directed Spray	Registered in bananas for control of various grass and broadleaf weeds . Add to directed application of paraquat under favourable growing conditions.	NR	A	NSW, QLD & WA	R3
Diquat & Paraquat (SpraySeed)	L**	Orchards / Directed Spray or Spot Spray	Registered in bananas for control of annual grass and broadleaf weeds . Apply as a directed spray or spot spray to weeds. Avoid contact with crop foliage.	H:NR G:7	A	ALL	R3
Fluazifop – P (Fusilade)	A***	Banana / Directed Spray	Registered in bananas for control of various grass weeds . Direct the spray to the base of the tree. Repeat sprays may be necessary if grass is more advanced.	NR	A	NSW, QLD, NT & WA	-
Glufosinate (Basta)	N**	Banana / Directed or Shielded Spray	Registered in bananas for control of various grass and broadleaf weeds . Apply as a directed or shielded spray. Do not allow spray to contact desirable foliage or green bark.	H:NR G:56	A	ALL	R3
Glyphosate (Roundup)	M**	Banana / Directed Spray, Shielded Spray or Wick Wiper	Registered in bananas for control of various grass and broadleaf weeds . Apply when weeds are actively growing.	NR	A	ALL	R3
Haloxifop (Verdict)	A***	Banana / Directed Spray or Spot Spray	Registered in bananas for control of various grass weeds . Spray should be directed to the base of the tree avoiding contact with fruit and foliage.	NR	A	ALL	-

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory Risk
Oryzalin	D**	Banana / Directed Spray	Registered in bananas for control of various grass and broadleaf weeds . Area to be treated should be free of established weeds. Remove or thoroughly mix trash into the soil before application. Incorporation by rain or irrigation (at least 12.5mm) is required within 21 days of application to activate the product. If moisture is not received it can be mechanically incorporated into the to 2.5cm of soil.	NR	A	ALL	-
Pendimethalin (Stomp)	D**	Banana / Directed Spray, Requires Incorporation	Registered in bananas for control of various grass and broadleaf weeds . Use a directed spray avoiding spray contact with green bank, fruit and foliage. Requires incorporation by mechanical means or rainfall/irrigation within 10 days of application.	NR	A	ALL	-
Paraquat (Gramoxone)	L**	Orchards / Directed Spray	Registered in orchards for control of annual grass and broadleaf weeds . Avoid contacting crop foliage. Apply soon after weed emergence and before weeds reach 15cm in height.	H:NR G:1	A	Qld, Vic, Tas, SA, WA, NT	R3
Control of Banana Suckers							
There are limited, but effective herbicide options available for controlling banana suckers							
2,4-D	I**	Bananas / Injection or Spray / To Destroy Banana Suckers	Registered for control of banana suckers . Apply either as a stem injection or a foliar spray, after the corms have formed broad adult leaves.	NR	A	QLD	R3
2,4-D PER14239	I**	Cavendish Bananas / Injection / Banana Suckers	Permitted for control of banana suckers . Apply by stem injection only.	NR	A	NSW	R3
Diesel Distillate PER14237		Bananas / Cut Stump or Injection / Removal of Unwanted Suckers	Permitted for control of banana suckers . Cut suckers at ground level and treat cut with undiluted diesel, or Inject undiluted diesel at the growing point of the sucker.	NR	A	NSW, QLD, WA & NT	-

Active ingredient (Trade Name)	Chemical Group	Crop/ Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory Risk
Ethephon PER14966		Bananas / Crop Timing Management	Permitted for control of pseudostems for crop timing management in bananas. Apply one injection of 4 mL prepared solution per pseudostem per season using an adjustable injector or syringe. Pseudostem injection should be made at approximately 0.75 m above the ground, targeted to the centre of the pseudostem and angled down at approximately 45 degrees to prevent product from running back out of the injection site. Treat plants in the height range of 2 to 3 m with good growth. Completely remove the leaf canopy of injected plants at the time of treatment, or within 5 days of treatment.	NR	A	QLD	-
Glyphosate (Roundup) PER14850	M**	Banana / Injection / Destruction of Banana Plants	Registered for destruction of banana plants . Inject glyphosate mix into the pseudostem above the growing point. Inject suckers up to 1 metre tall at 1 point and taller plants at 2 points around the stem. No fruit from plants treated can be sold or consumed.	H:NR NG	A	ALL	R3

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/Details/F2020C00713
APVMA Permit search	https://productsearch.apvma.gov.au/permits
APVMA Product search	https://productsearch.apvma.gov.au/products
Codex MRL database	http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/
Qld Dept of Agriculture and Fisheries	https://www.daf.qld.gov.au/business-priorities/agriculture/plants/fruit-vegetable
Australian Banana Growers Council	www.abgc.org.au
Cotton Pest Management Guide 2019-20	https://www.cottoninfo.com.au/publications/cotton-pest-management-guide
CropLife Australia	https://www.croplife.org.au/
Growcom – Infopest Database	www.infopest.com.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, 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 banana

Appendix 2. Products available for control of insects, mites and nematode pests in banana

Appendix 3. Products available for weed control in banana

Appendix 4. Current permits for use in banana

Appendix 5. Banana Maximum Residue Limits (MRLs)

Appendix 6. Banana Agrichemical Regulatory Risk Assessment

Appendix 1. Products available for disease control in bananas

Active Ingredient (Trade Name)	Chemical Group	Situation	Diseases / Comments	States	WHP Days	Regulatory Risk
<i>Bacillus amyloliquifaciens</i> Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide)	44	Bananas	Yellow Sigatoka (<i>Mycosphaerella musicola</i>) Common Leaf Speckle (<i>Mycosphaerella musae</i>) (Suppression only)	ALL	NR	-
Benzalkonium chloride, Didecyldimethyl ammonium chloride PER86485		Sanitising and Decontamination of Agricultural Surfaces and Equipment	Panama Disease (Race 4) (<i>Fusarium oxysporum f. sp. Cubense</i>)	ALL	NR	-
Chlorothalonil (Bravo)	M5	Bananas	Leaf Spot (<i>Mycosphaerella musicola</i>)	QLD, NSW, NT & WA	1	R3
Copper (Cu) as copper ammonium complex	M1	Bananas	Yellow Sigatoka (<i>Mycosphaerella musicola</i>)	QLD, NSW, WA & NT	1	-
			Phytophthora Stem Canker	NSW, WA		
Copper (Cu) present as copper oxychloride	M1	Bananas	Cercospora Leaf Spot (<i>Cercospora musae</i>)	NSW, QLD & WA	1	-
Copper (Cu) present as cupric hydroxide	M1	Bananas	Cercospora Leaf Spot	QLD, NSW & WA	1	-
			Phytophthora Stem Canker	NSW, WA		
Copper (Cu) present as tribasic copper sulfate	M1	Bananas	Cercospora Leaf Spot	QLD, NSW & WA	1	-
			Phytophthora Stem Canker	ALL		
Didecyl Dimethyl Ammonium Chloride (Steri-Max Biocide)		Bananas / Sanitation & Water Treatment	<i>Fusarium oxysporum f. sp. cubense</i> (Rac1, Foc)	ALL	NR	-

Active Ingredient (Trade Name)	Chemical Group	Situation	Diseases / Comments	States	WHP Days	Regulatory Risk
Difenoconazole (Score)	3	Bananas	Yellow Sigatoka (<i>Mycosphaerella musicola</i>) Black Sigatoka (<i>Mycosphaerella fijiensis</i>)	QLD, NSW & NT	1	R3
Epoxiconazole (Opus)	3	Bananas (bagged)	Leaf Spot /Yellow Sigatoka (<i>Mycosphaerella musicola</i>) Leaf Speckle (<i>Mycosphaerella musae</i>)	ALL	1	R3
Fluopyram (Luna Privilege)	7	Bananas	Yellow Sigatoka Leaf Speckle Cordana Leaf Spot	QLD, NSW, WA & NT	NR	-
Fluopyram + Tebuconazole (Luna Experience)	7 + 3	Bananas	Yellow Sigatoka (<i>Mycosphaerella musicola</i>) Leaf Speckle (<i>Mycosphaerella musae</i>) Cordana Leaf Spot (<i>Cordana musae</i>)	ALL	1	R3
Fluxapyroxad (Sercadis)	7	Bananas	Yellow Sigatoka (<i>Mycosphaerella musicola</i>) Leaf Speckle (<i>Mycosphaerella musae</i>)	ALL	NR	-
Mancozeb	M3	Bananas	Leaf Spot (<i>Mycosphaerella musicola</i>) Black Pit Cordana Leaf Spot Fruit Speckle Leaf Speckle	ALL	NR	R2
Mancozeb PER81199	M3	Banana Bunches	Banana Fruit Speckle (<i>Colletotrichum musae</i> and <i>Fusarium spp</i>)	NSW, NT, QLD & WA	35	R2
Metiram (Polyram)	M3	Bananas	Leaf Spot (<i>Mycosphaerella musicola</i>) Black Pit Cordana Leaf Spot Fruit Speckle Leaf Spot	ALL	NR	R2

Active Ingredient (Trade Name)	Chemical Group	Situation	Diseases / Comments	States	WHP Days	Regulatory Risk
Petroleum Oil		Bananas	Cercospora Leaf Spot, Leaf Speckle, Cordana Leaf Spot	NSW, QLD	1	-
Prochloraz (Sportak)	3	Bananas / Post-Harvest Spray	Anthracoze (Black-End) (<i>Colletotrichum musae</i>)	QLD, NSW, WA & NT	NR	-
Propiconazole (Tilt)	3	Bananas	Leaf Spot (<i>Mycosphaerella musicola</i>) Leaf Speckle (<i>Mycosphaerella musae</i>) Cordana Leaf Spot (<i>Cordana johnstonii</i>) Black Sigatoka (<i>Mycosphaerella fijiensis</i>)	QLD, NSW, WA & NT QLD, WA & NT	1	R2
Pyraclostrobin (Cabrio)	11	Bananas (bagged)	Leaf Speckle (<i>Mycosphaerella musae</i>) Leaf Spot (<i>Mycosphaerella musicola</i>) Black Sigatoka (<i>Mycosphaerella fijiensis</i>)	ALL	NR	-
Pyrimethanil (Scala)	9	Bananas	Yellow Sigatoka (<i>Mycosphaerella musicola</i>) Leaf Speckle (<i>Mycosphaerella musae</i>) Cordana Leaf Spot (<i>Cordana musae</i>)	QLD, NSW, WA & NT	NR	-
Tebuconazole (Folicur)	3	Bananas	Leaf Spot /Yellow Sigatoka Leaf Speckle Black Sigatoka	QLD, NSW, WA & NT	1	R3
Thiabendazole (Tecto)	1	Bananas / Post-Harvest Dip	Squirter Disease (<i>Nigrospora musae</i>) Black-End Rot (<i>Gloeosporium musarum</i>) Crown Rot Black-End Rot (<i>Gloeosporium musae</i>) <i>Fusarium, Deighthoniella, Verticillium spp</i>	NSW, WA QLD, WA	NR	-
Trifloxystrobin (Flint)	11	Bananas	Yellow Sigatoka Black Sigatoka Cordana Leaf Spot	QLD, NSW, WA & NT	NR	-
Zineb	M3	Bananas	Cercospora Leaf Spot Speckle	QLD, NSW & WA	7	R2

Appendix 2. Products available for control of insect, mites and nematode pests in bananas

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory Risk
Acephate (Orthene)	1B	Bananas	Banana Scab Moth (<i>Nacoleia octasema</i>) Banana Flower Thrips (<i>Thrips hawaiiensis</i>) Banana Rust Thrips (<i>Chaetanaphothrips signipennis</i>)	QLD, NSW, WA, NT	NR	R3
Bifenthrin (Talstar 100EC / 250EC)	3A	Bananas	Banana Weevil Borer (<i>Cosmopoliles sordidus</i>) Banana Rust Thrips (<i>Chaetanaphothrips signipennis</i>)	QLD, NSW, WA, NT	1	-
			Strawberry Spider Mite (<i>Tetranychus lambi</i>)	QLD, WA	8	
Bifenthrin (Talstar 80SC)	3A	Bananas	Banana Scab Moth (<i>Nacoleia octasema</i>)	QLD	NR	-
			Flower Thrips (<i>Thrips florum</i>)	QLD, NSW		
Cadusafos (Rugby)	1B	Bananas	Burrowing Nematode (<i>Radopholus similis</i>) Root-Knot Nematode (<i>Meloidogyne spp</i>) Spiral Nematode (<i>Helicotylenchus dihystern</i>)	NSW, WA	14	-
			Burrowing Nematode (<i>Radopholus similis</i>) Banana Weevil Borer (<i>Cosmopoliles sordidus</i>)	QLD		
Chlorpyrifos (Lorsban)	1B	Bananas	Banana Scab Moth	QLD	14	R1
			Banana Weevil Borer	QLD, NSW		
			Caterpillars	NSW		
Chlorpyrifos (Lorsban) PER14240	1B	Bananas / Dusting Bunches	Sugar Cane Bud Moth Banana Scab Moth Banana Rust Thrips Mealybugs Caterpillars	NSW, QLD, NT, WA	14	R1

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory Risk
Clofentozine (Apollo)	10A	Bananas	Two-Spotted Mite (<i>Tetranychus urticae</i>) Strawberry Spider Mite (<i>Tetranychus lambi</i>)	QLD, NSW, WA	NR	-
Clothianidin (Shield)	4A	Bananas	Weevil Borer Rust Thrips	ALL	NR	R2
Diazinon	1B	Bananas	Banana Beetle Borer	NSW	14	R3
			Banana Rust Thrip	QLD		
Dicofol (Miti-Fol)	2B	Bananas	Two Spotted Mite Strawberry Spider Mite	QLD	7	R1
Dimethoate	1B	Bananas / Post-Harvest Dip	Fruit Fly	NSW, WA	NR	R1
		Bananas / Post-Harvest Dip / Quarantine Treatment	Queensland Fruit Fly (<i>Bactrocera tryoni</i>)	QLD		
Dimethoate PER87164)	1B	Bananas / Post-Harvest Spray	Queensland Fruit Fly (<i>Bactrocera tryoni</i>) Lesser Queensland Fruit Fly (<i>Bactrocera neohumeralis</i>) Northern Territory or Darwin Fruit fly (<i>Bactrocera aquilonis</i>) Mediterranean fly (<i>Ceratitis capitata</i>)	ALL	NR	R1
		Bananas / Post-Harvest Dip	Queensland Fruit Fly (<i>Bactrocera tryoni</i>) Northern Territory or Darwin Fruit fly (<i>Bactrocera aquilonis</i>) Mediterranean fly (<i>Ceratitis capitata</i>)			
Ethyl Formate (Vapormate)		Bananas / Post-Harvest Fumigant	Mites (<i>Oligotetranychus spp</i>) Mealybugs (<i>Dysmicoccus spp</i>) Scale (<i>Aspidiotus spp</i>) Coffee Bean Weevil (<i>Araecerus fasciculatus</i>)	ALL	NR	-

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory Risk
Etoxazole (Paramite)	10B	Bananas	Strawberry Mite (<i>Tetranychus lambi</i>)	ALL	1	-
Fenbutatin Oxide (Torque)	12A	Bananas	Two-Spotted Mite (<i>Tetranychus urticae</i>) Banana Spider Mite (<i>Tetranychus lambi</i>)	QLD, NSW, NT	1	R2
Fatty Acids – Potassium Salt (Natrasoap)		Fruit	Soft control option with activity on aphids, thrips, mealybug, spider mite and whitefly.	ALL	NR	-
Fipronil (Regent)	2B	Bananas	Banana Rust Thrips (<i>Chaetanaphothrips signipennis</i>) Banana Weevil Borer (<i>Cosmopolites sordidus</i>)	QLD, NSW, WA, NT	NR	-
Imidacloprid (Confidor Guard)	4A	Bananas – Cavendish	Banana Rust Thrips (<i>Chaetanaphothrips signipennis</i>)	NTH QLD, NT, NTH WA	NR	R2
			Banana Weevil Borer (<i>Cosmopolites sordidus</i>)	QLD, NSW, NT, WA		
		Bananas – Lady Finger	Banana Weevil Borer (<i>Cosmopolites sordidus</i>)	QLD, NSW, NT, WA		
Imidacloprid (Confidor Guard) + Paraffinic Oil PER14850	4A	Banana / Control Susceptible Disease Vectors	Banana Aphid	ALL	NR NG	R2
Petroleum Oil		Bananas	Scale Insects	QLD, NSW, WA	1	-
Propargite (Omite)	12C	Bananas	Two-Spotted Mite	QLD, NSW, ACT, WA	7	R3
Prothiofos (Tokuthion)	1B	Bananas Bananas (harvested or fallen stools)	Banana Weevil Borer	QLD, NSW, NT, WA	NR	-
		Banana Plant (residual plant only)		NSW		

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory Risk
Pyridaben (Sanmite)	10A	Bananas	Strawberry Mite (<i>Tetranychus lambi</i>) Two-Spotted Mite (<i>Tetranychus urticae</i>)	QLD, NSW, WA & NT	1	-
Spinetoram (Success Neo)	5	Bananas	Banana Rust Thrips Sugarcane Bud Moth	ALL	NR	-
		Tropical and Sub-Tropical Fruit Crops (Inedible Peel)	Flower-Eating Caterpillars Leafrollers & Loopers Yellow Peach Moth Red-Banded Thrips Sorghum Head Caterpillar			
Spinetoram (Success Neo) PER87198	5	Bananas	Banana Rust Thrips (<i>Chaetanaphothrips signipennis</i>) Banana Flower Thrips (<i>Thrips hawaiiensis</i>) Flower-Eating Caterpillars such as Sugarcane Bud Moth (<i>Opogona glycyphaga</i>) Scab Moth (<i>Nacoleia octasema</i>)	NSW, NT, QLD & WA	NR	-
Spinetoram (Success Neo) PER89241	5	Bananas	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL (excl. VIC)	NR	-
Spinosad (Entrust) PER87068	5	Organic Bananas	Rust Thrips (<i>Chaetanaphothrips signipennis</i>)	NSW, NT, QLD & WA	H:56 G:14	-
Spirotetramat + Imidacloprid (Movento Energy)	23+4A	Bananas - Cavendish	Banana Rust Thrips (<i>Chaetanaphothrips signipennis</i>)	NTH QLD, NT & NTH WA	NR	R2
		Bananas – Lady Finger	Banana Weevil Borer (<i>Cosmopolites sordidus</i>)	QLD, NSW, NT & WA		

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory Risk
Spirotetramat + Imidacloprid (Movento Energy) PER88359	23+4A	Bananas	Banana Aphid (<i>Pentalonia nigronervosa</i>)	QLD, NSW, NT & WA	NR	R2
Sulfur PER9409	UN	Banana Bunches	Mites (<i>Tetranychus lambi</i> and <i>Tetranychus urticae</i>)	NSW, QLD	NR	-
Terbufos (Counter)	1B	Bananas	Banana Weevil Borer Burrowing Nematode (<i>Radopholus similis</i>)	ALL	NR	R3

Appendix 3. Products available for weed control in bananas

Active ingredient (Trade Name)	Chemical Group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory Risk
2,2-DPA	J**	Bananas / Directed Spray	Annual and perennial grasses.	7	NSW, QLD	-
2,4-D	I**	Bananas / Injection or Spray / Sucker Destruction	Control of Banana Suckers	NR	QLD	R3
2,4-D PER14239	I**	Cavendish Bananas / Injection / Sucker Destruction	Control of Banana Suckers	NR	NSW	R3
Diesel Distillate PER14237		Bananas / Cut Stump or Injection / Removal of Unwanted Suckers	Control of Banana Suckers	NR	NSW, QLD, WA & NT	-
Diuron	C**	Bananas / Directed Spray	Grass and broadleaf weeds	NR	NSW, QLD & WA	R3
Diquat and Paraquat (SpraySeed)	L**	Orchards / Directed Spray or Spot Spray	Grass and broadleaf weeds	H:NR G:7	ALL	R3
Fluazifop – P (Fusilade)	A***	Banana / directed spray	Grass weeds	NR	NSW, QLD, NT & WA	-
Glufosinate (Basta)	N**	Banana / Directed or Shielded Spray	Grass and broadleaf weeds	H:NR G:56	ALL	R3
Glyphosate (Roundup)	M**	Banana / Directed Spray, Shielded Spray or Wick Wiper	Grass and broadleaf weeds	NR	ALL	R3
Glyphosate (Roundup) PER14850	M**	Banana / Injection / Destruction of Banana Plants	Control of Banana Suckers	NH NG	ALL	R3
Glyphosate present as Potassium Salt (Touchdown HiTech)	M**	Orchards / Directed Spray, Shielded Spray or Wick Wiper	Grass and broadleaf weeds	NR	ALL	R3
Haloxfop (Verdict)	A***	Orchards / Directed Spray or Spot Spray	Grass weeds	NR	ALL	-

Active ingredient (Trade Name)	Chemical Group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory Risk
Oryzalin	D**	Banana / Directed Spray	Grass and broadleaf weeds	NR	ALL	-
Pendimethalin (Stomp)	D**	Banana / Directed Spray, Requires Incorporation	Grass and broadleaf weeds	NR	ALL	-
Paraquat (Gramoxone)	L**	Orchards / Directed Spray	Grass and broadleaf weeds	H:NR G:1	QLD, VIC, TAS, SA, WA & NT	R3

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

Appendix 4. Current permits for use in bananas

Permit No.	Description	Issued Date	Expiry Date	States	Permit Holder
PER14237 Version 3	Diesel Distillate / Banana / Removal of Unwanted Suckers	1-Dec-13	31-Dec-24	NSW, QLD, NT & WA	Hort Innovation
PER88359	Movento Energy Insecticide/Bananas/Banana aphid	15-Dec-19	31-Dec-22	NSW, QLD, NT & WA	Hort Innovation
PER14850 Version 4	Glyphosate / Bananas / Destruction of Banana plants	1-Oct-14	30-Sep-24	ALL	Hort Innovation
PER9409 Version 3	Sulfur Dust / Banana Bunches / Mites	1-Oct-06	30-Sep-24	NSW, QLD	Hort Innovation
PER87198	Success Neo Insecticide / Bananas / Banana rust thrips, Banana flower thrips, flower eating caterpillars	5-Feb-19	28-Feb-24	NSW, QLD, NT & WA	Hort Innovation
PER86485	Benzalkonium chloride, Didecyldimethyl ammonium chloride / Sanitising, decontaminating / Fusarium Wilt or Panama disease of bananas	12-Jul-18	31-Jul-23	ALL	Hort Innovation
PER14966 Version 3	Ethephon / Bananas / Crop Timing Management	23-Dec-14	31-Aug-23	QLD	Australian Banana Growers Council C/- Hort Innovation
PER81199	Mancozeb / Banana bunches / Banana fruit speckle	27-Oct-15	31-Mar-21	NSW, QLD, NT & WA	Australian Banana Growers Council
PER14240 Version 2	Chlorpyrifos / Bananas / Sugarcane bud moth, Banana scab moth, Banana rust thrips, Caterpillars, Mealy bugs	28-Jun-13	30-Sep-20	NSW, QLD, NT & WA	Australian Banana Growers Council
PER14239	Nufarm Amicide/ Cavendish Bananas/ Destruction of Banana Suckers	1-Jul-13	30-Jun-23	NSW	Australian Banana Growers Council
PER14235	Rattoff Zinc Phosphine Bait Sachet / Banana Plantations / Roof or Black Rat and Mice	1-Jul-13	30-Jun-23	NSW, QLD, NT & WA	Australian Banana Growers Council
PER87164 Version 2	Dimethoate / Specified Citrus, Tropical Fruit commodities / Various Fruit Fly species	1-Mar-19	31-Mar-24	ALL	Hort Innovation
PER89241	Success Neo and Delegate Insecticide / Various Crops / Fall Armyworm	06-Mar-20	31-Mar-23	ALL (excl. VIC)	Hort Innovation

Appendix 5. Banana Maximum Residue Limits (MRLs)

CODEX commodity groupings of tropical fruits and subgroups:

AO2 0002	Fruits (except as otherwise listed)
FI 0030	Assorted tropical and sub-tropical fruits - inedible peel
FI 0327	Banana

Note: Most banana production is consumed by the Australian domestic market. Australian MRLs are therefore the most critical in assessing product suitability from a crop residue perspective. Available information indicates that in the absence of specific limits in legislation, most 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	Description	APVMA MRL mg/kg	Codex MRL mg/kg
2,2-DPA	FI0327	Banana	*0.1	
Acephate see also Methamidophos	FI0327	Banana	1	
Acibenzolar-S-methyl	FI0327	Banana		0.06
Aldrin and Dieldrin	FI 0327	Banana	E0.05	
		Fruits	E0.05	
Amitrole	FI 0327	Banana	*0.01	
Azoxystrobin	FI 0327	Banana	T0.5	2
Bendiocarb	FI 0327	Banana	*0.02	
Bifenthrin	FI 0327	Banana	0.1	0.1
Bitertanol	FI 0327	Banana		0.5
Boscalid	FI 0327	Banana		0.6
Bromide Ion	AO2 0002	Fruits		20
Buprofezin	FI 0327	Banana		0.3
Cadusafos	FI 0327	Banana	*0.01	0.01
Carbendazim	FI 0327	Banana		0.2
Carbofuran	FI 0327	Banana		*0.01
Carfentrazone-ethyl	FI 0030	Tropical - inedible peel	*0.05	
Chlorothalonil	FI 0327	Banana	3	15
Chlorpyrifos	FI 0327	Banana	T0.5	2
Clofentezine	FI 0327	Banana	*0.01	
Clothianidin	FI 0327	Banana	*0.02	0.02
DDT		Fruits	E1	
Diazinon		Fruits	0.5	
Dicofol		Fruits	5	
Didecyldimethylammonium chloride	FI 0030	Tropical - inedible peel	20	
Difenoconazole	FI 0327	Banana	*0.02	0.1
Dimethoate see also Omethoate	FI 0030	Tropical - inedible peel	5	
Diquat		Fruits	*0.05	
	FI 0327	Banana		*0.02

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Dithianon		Fruits	2	
Dithiocarbamates	FI 0327	Banana		2
Dithiocarbamates (mancozeb, metham, metiram, thiram, zineb and ziram)	FI 0327	Banana	T15	
Diuron	FI 0327	Banana	0.5	
Epoxiconazole	FI 0327	Banana	1	
Ethephon	FI 0327	Banana	*T0.05	
Ethoprophos	FI 0327	Banana		0.02
Etoxazole	FI 0327	Banana	0.2	
Fenamiphos	FI 0327	Banana	*0.05	*0.05
Fenarimol	FI 0327	Banana		0.2
Fenbuconazole	FI 0327	Banana	0.5	0.05
Fenbutatin Oxide	FI 0030	Tropical - inedible peel	5	
	FI 0327	Banana		10
Fenpicoxamid	FI 0327	Banana		0.15
Fenpropimorph	FI 0327	Banana		2
Fipronil	FI 0327	Banana	*0.01	0.005
Fluazifop-p-butyl	FI 0327	Banana	*0.02	*0.01
Fluopyram	FI 0327	Banana	0.1	0.8
Flusilazole	FI 0327	Banana		0.03
Flutriafol	FI 0327	Banana		0.3
Fluxapyroxad	FI 0327	Banana	0.7	3
Glufosinate and Glufosinate ammonium	FI 0030	Tropical - inedible peel	0.2	
Glufosinate-Ammonium	FI 0327	Banana		0.2
Glyphosate	FI 0327	Banana	0.2	*0.05
Haloxypop	FI 0030	Tropical - inedible peel	*0.05	
	FI 0327	Banana		*0.02
Imazalil	FI 0327	Banana		Po3
Imidacloprid	FI 0327	Banana	0.5	0.05
Inorganic bromide		Fruits	20	
Isopyrazam	FI 0327	Banana		0.06
Isoxaben	FI 0030	Tropical - inedible peel	*0.01	
Lindane		Fruits	E0.5	
Maldison		Fruits	2	
Metaldehyde		Fruits	1	
Methamidophos	FI 0327	Banana	0.2	
Methiocarb		Fruits	T0.1	
Methyl bromide		Fruits	*T0.05	
Omethoate		Fruits	2	
Oryzalin		Fruits	0.1	
Oxamyl	FI 0327	Banana	0.2	

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Oxyfluorfen	FI 0030	Tropical - inedible peel	*0.01	
Paclobutrazol	FI 0030	Tropical - inedible peel	*0.01	
Paraquat		Fruits	*0.05	
	FI 0030	Tropical - inedible peel		*0.01
Pendimethalin	FI 0030	Tropical - inedible peel	*0.05	
Phosphine	FI 0030	Tropical - inedible peel	*T0.01	
Piperonyl butoxide		Fruits	8	
Pirimicarb		Fruits	0.5	
Prochloraz	FI 0327	Banana	5	
	FI 0030	Tropical - inedible peel		Po7
Propargite	FI 0327	Banana	3	
Propiconazole	FI 0327	Banana	0.2	0.1
Prothiofos	FI 0327	Banana	*0.01	
Pyraclostrobin	FI 0327	Banana	*0.02	*0.02
Pyrethrins		Fruits	1	
Pyridaben	FI 0327	Banana	0.5	
Pyrimethanil	FI 0327	Banana	2	0.1
Saflufenacil	FI 0327	Banana		0.01
Simazine		Fruits	*0.1	
Spinetoram	FI 0030	Tropical - inedible peel	0.3	
Spinosad	FI 0030	Tropical - inedible peel	0.3	
Spirotetramat	FI 0327	Banana	0.3	
Spiroxamine	FI 0327	Banana	T5	
Tebuconazole	FI 0327	Banana	0.2	1.5
Terbufos	FI 0327	Banana	0.05	0.05
Thiabendazole	FI 0327	Banana	3	Po5
Thiamethoxam	FI 0327	Banana		*0.02
Triadimefon	FI 0327	Banana		1
Triadimenol	FI 0327	Banana		1
Trichlorfon	FI 0030	Tropical - inedible peel	T3	
Trifloxystrobin	FI 0327	Banana	0.5	0.05
Trifluralin		Fruits	*0.05	

NOTE: For the groups "Assorted tropical and sub-tropical fruits - inedible peel" and "Fruits" listed above, (banana) crop group exclusions (if any) have not been specified.

* 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 2019. Compilation 4. Prepared 15 January 2020. CODEX MRLs: CODEX Alimentarius International Food Standards database (February 2020), <http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/>

Appendix 6. Banana Agrichemical Regulatory Risk Assessment

Banana Agrichemical Regulatory Risk Assessment

25 July 2019

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 an 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 bananas, as well as current initiatives aimed at addressing identified pest management deficiencies.

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

Pest Name	Active Constituents	MoA	Comment	Activities
Insect and mite pests				
Ants ⁴	Pyriproxyfen	7C		
Beetles				
Banana weevil borer	Bifenthrin	3A		Registration for Tetraniliprole (Vayego) for Weevil Borer in bananas expected 2020.
	Cadusafos	1B	EU - Deregistered	
	Chlorpyrifos	1B	Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally Canada – proposed cancellation of most agricultural uses. USA – EPA decision (18/7/19) is to allow continued use	
	Clothianidin	4A	Canada – Proposal to cancel foliar use in orchards, strawberries and turf Europe – Outdoor uses deregistered	
	Diazinon	1B	To be reviewed by JMPR/Codex 2020/21	
	Fipronil	2B		
	Imidacloprid	4A	Canada – Proposed cancelling majority of foliar and soil uses EU – Removal of all field uses	
	Oxamyl	1A		
	Prothiofos	1B	EU - Deregistered	
	Spirotetramat	23		
	Terbufos	1B	EU - Deregistered	

⁴ Black ants, Coastal brown ant, Exotic yellow crazy ant, Green tree ant, Greenhead (Pony) ants, Meat ants, Long legged ants, Pennant (Pavement) ants, Red imported fire ant, Singapore ant, Sugar ants, Tramp ants, Tropical fire ant, Tyrant ants

Pest Name	Active Constituents	MoA	Comment	Actions
Grey back cane beetle (Larvae)	Imidacloprid	4A	Canada – Proposed cancelling majority of foliar and soil uses EU – Removal of all field uses	
Caterpillars				
Banana scab moth	Acephate	1B	APVMA – Nominated for review Canada – Under review Europe - Deregistered	
	Bifenthrin	3A		
	Bt	11		
	Chlorpyrifos	1B	Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally Canada – proposed cancellation of most agricultural uses. USA – EPA decision (18/7/19) is to allow continued use	
	Spinetoram (PER87198)	5		
Caterpillars	Chlorpyrifos	1B	Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally Canada – proposed cancellation of most agricultural uses. USA – EPA decision (18/7/19) is to allow continued use	Spinosad is being re-registered for organic bananas
Cluster caterpillar	Chlorpyrifos	1B	Canada – proposed cancellation of most agricultural uses. USA – EPA decision (18/7/19) is to allow continued use	
Flower eating caterpillars	Spinetoram	5		
Leafroller (Tortrix) caterpillars	Spinetoram	5		
Leafroller moths	Spinetoram	5		
Loopers	Spinetoram	5		
Sorghum head caterpillar	Spinetoram	5		
Sugarcane bud moth	Chlorpyrifos (PER14240)	1B	Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally Canada – proposed cancellation of most agricultural uses. USA – EPA decision (18/7/19) is to allow continued use	
	Spinetoram (PER87198)	5		
Yellow peach moth	Spinetoram	5		

Pest Name	Active Constituents	MoA	Comment	Actions
Fruit fly				
Fruit fly	Dimethoate (Po)	1B	To be reviewed by Codex 2019/20. Europe – Proposing to drop all MRLs to <0.01 mg/kg.	
Mites				
Bunch mites	Sulfur (PER9409)	M2		
Strawberry (Banana) spider mite	Bifenthrin	3A		
	Clofentezine	10A		
	Dicofol	UN	No Codex MRLs Nominated for listing under the Stockholm Convention. Nominated for APVMA review.	
	Etoxazole	10B		
	Fenbutatin oxide	12B	APVMA – Nominated for review Codex - To be reviewed 2020/21 No supporting registrant	
	Pyridaben	21A		
Two-spotted (Red spider) mite	Clofentezine	10A		
	Dicofol	UN	No Codex MRLs Nominated for listing under the Stockholm Convention. Nominated for APVMA review.	
Two-spotted (red spider) mites	Fenbutatin oxide	12B	APVMA – Nominated for review Codex - To be reviewed 2020/21 No supporting registrant	
	Propargite	12C	APVMA – nominated for review	
	Pyridaben	21A		
Passionvine mite	Chlorpyrifos	1B	Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally Canada – proposed cancellation of most agricultural uses. USA – EPA decision (18/7/19) is to allow continued use	

Pest Name	Active Constituents	MoA	Comment	Actions
Nematodes				
Burrowing nematode	Cadusafos	1B	EU - Deregistered	
	Oxamyl	1A		
	Terbufos	1B	EU - Deregistered	
Nematodes	Fenamiphos	1B		
Root-knot nematodes	Cadusafos	1B	EU - Deregistered	
Spiral nematode	Cadusafos	1B	EU - Deregistered	
	Oxamyl	1A		
Scale and mealybug				
Mealybugs	Chlorpyrifos	1B	Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally Canada – proposed cancellation of most agricultural uses. USA – EPA decision (18/7/19) is to allow continued use	
Scale insects	Paraffinic oil			

Pest Name	Active Constituents	MoA	Comment	Actions
Thrips				
Banana flower thrips	Acephate	1B	APVMA – nominated for review EU - Deregistered	Spinosad is being re-registered for organic bananas
	Bifenthrin	3A		
	Chlorpyrifos	1B	Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally Canada – proposed cancellation of most agricultural uses. USA – EPA decision (18/7/19) is to allow continued use	
	Spinetoram (PER87198)	5		
Banana rust thrips	Acephate	1B	APVMA – nominated for review EU - Deregistered	
	Bifenthrin	3A		
	Chlorpyrifos	1B	Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally Canada – proposed cancellation of most agricultural uses. USA – EPA decision (18/7/19) is to allow continued use	
	Clothianidin	4A	Canada – Proposal to cancel foliar use in orchards strawberries and turf Europe – Outdoor uses deregistered	
	Diazinon	1B	To be reviewed by JMPR/Codex 2020/21.	
	Fipronil	2B		
	Imidacloprid	4A	Canada – Proposed cancelling majority of foliar and soil uses EU – Removal of all field uses	
Banana rust thrips	Spirotetramat	23		Spinosad is being re-registered for organic bananas
	Spinetoram (PER87198)	5		
Redbanded thrips	Spinetoram	5		

Pest Name	Active Constituents	MoA	Comment	Actions
Aphids				
Banana Aphid	Fatty Acids – Potassium Salt			Residue and efficacy trials underway to support new label registration for Afidopyropen (Versys) with BASF. Due for completion Jan 2023.
	Spirotetramat	23		
	Imidacloprid	4A	Canada – Proposed cancelling majority of foliar and soil uses EU – Removal of all field uses	

Problem	Active Constituents	MoA	Comment	Actions
Diseases				
Anthracnose (Black end)	Copper	M1		
	Mancozeb	M3	APVMA - Nominated for review Canada – Under review Codex - To be reviewed 2020/21	
	Prochloraz	3		
	Thiabendazole	1		
Black pit	Mancozeb	M3	APVMA - Nominated for review Canada – Under review Codex - To be reviewed 2020/21	
	Metiram	M3	APVMA - Nominated in proposed dithiocarbamate review Canada – Proposed cancelling of all foliar uses except in potato Codex – Dithiocarbamates to be reviewed 2020/21	
Black Sigatoka	Difenoconazole	3	APVMA - Nominated for review	
	Fenbuconazole	3	APVMA - Nominated for review	
	Paraffinic oil	-		
	Propiconazole	3	APVMA - Nominated for review Europe – Deregistered – being phased-out	
	Pyraclostrobin	11		
	Tebuconazole	3	APVMA - Nominated for review	
	Trifloxystrobin	11		
Black tip	Thiabendazole	1		
Cercospora leaf spot	Paraffinic oil	-		
Cordana leaf spot	Fluopyram	7		Fluopyram (Luna) to be replaced with recently registered Luna Experience (Fluopyram + Tebuconazole).
	Mancozeb	M3	APVMA - Nominated for review Canada – Under review Codex - To be reviewed 2020/21	

Pest Name	Active Constituents	MoA	Comment	Actions
Cordana leaf spot	Metiram	M3	APVMA - Nominated in proposed dithiocarbamate review Canada – Proposed cancelling of all foliar uses except in potato Codex – Dithiocarbamates to be reviewed 2020/21	
	Paraffinic oil	-		
	Propiconazole	3	APVMA - Nominated for review Europe – Deregistered – being phased-out	
	Pyrimethanil	9		
	Trifloxystrobin	7		
Crown rot	Thiabendazole	1		
Deightoniella fruit spot	Mancozeb	M3	APVMA - Nominated for review Canada – Under review Codex - To be reviewed 2020/21	
Fruit speckle	Mancozeb	M3	APVMA - Nominated for review Canada – Under review Codex - To be reviewed 2020/21	
	Metiram	M3	APVMA - Nominated in proposed dithiocarbamate review Canada – Proposed cancelling of all foliar uses except in potato Codex – Dithiocarbamates to be reviewed 2020/21	
Fungi	Iodine	M		
Leaf speckle	Chlorothalonil	M5	APVMA - Nominated for review Canada – Review recently completed; continued use considered acceptable Europe - Deregistration proposed.	
	Copper	M1		
	Epoxiconazole	3	APVMA - Nominated for review EU- France has moved to ban all epoxiconazole based products	
	Fluxapyroxad	7		

Pest Name	Active Constituents	MoA	Comment	Actions
	Fluopyram	7		Fluopyram (Luna) to be replaced with recently registered Luna Experience (Fluopyram + Tebuconazole).
Leaf speckle	Mancozeb	M3	APVMA - Nominated for review Canada – Under review Codex - To be reviewed 2020/21	
	Metiram	M3	APVMA - Nominated in proposed dithiocarbamate review Canada – Proposed cancelling of all foliar uses except in potato Codex – Dithiocarbamates to be reviewed 2020/21	
	Paraffinic oil	-		
	Propiconazole	3	APVMA - Nominated for review Europe – Deregistered – being phased-out	
	pyraclostrobin	11		
	Pyrimethanil	9		
	Tebuconazole	3	APVMA - Nominated for review	
	Zineb	M3	APVMA - Nominated for review Canada – Proposed cancelling of all uses Codex - To be reviewed 2020/21	
Panama disease	Didecyl dimethyl NH ₄ Cl	-		
Phytophthora stem rot	Copper	M1		
Ripe fruit spot	Thiabendazole	1		
Sanitizer	Didecyl dimethyl NH ₄ Cl	-		
Scale insects	Paraffinic oil	-		
Squirter	Thiabendazole	1		
Trunk (Stem) canker	Copper	M1		
Yellow Sigatoka (Leaf spot)	Chlorothalonil	M5	APVMA - Nominated for review Canada – Review recently completed; continued use considered acceptable	

Pest Name	Active Constituents	MoA	Comment	Actions
			Europe - Deregistration proposed.	
	Copper	M1		
	Difenoconazole	3	APVMA - Nominated for review	
	Epoxiconazole	3	APVMA - Nominated for review EU- France has moved to ban all Epoxiconazole based products	
	Fenbuconazole	3	APVMA - Nominated for review	
	Fluopyram	7		
	Fluxapyroxad	7		
	Mancozeb	M3	APVMA - Nominated for review Canada – Proposed cancelling of all uses Codex - To be reviewed 2020/21	
	Metiram	M3	APVMA - Nominated in proposed dithiocarbamate review Canada – Proposed cancelling of all foliar uses except in potato Codex – Dithiocarbamates to be reviewed 2020/21	
	Paraffinic oil	-		
	Propiconazole	3	APVMA - Nominated for review Europe – Deregistered – being phased-out	
	Pyraclostrobin	11		
	Pyrimethanil	9		
	Tebuconazole	3	APVMA - Nominated for review	
	Trifloxystrobin	7		
	Zineb	M3	APVMA - Nominated for review Canada – Proposed cancelling of all uses Codex - To be reviewed 2020/21	

Pest Name	Active Constituents	MoA	Comment	Actions
WEEDS				
Broadleaf weeds and grasses	2,2-DPA	J		
	2,4-D	I	APVMA – Currently under review	
	Diquat	L	APVMA - Currently under review Europe – deregistered	
	Diuron	C	EU: Authorisation expires Sept 2020	
	Fluazifop-P	A		
	Glufosinate	N	Europe – deregistered	
	Glyphosate	M	Ongoing issues internationally	
	Haloxifop	A		
	Oryzalin	D		
	Paraquat	L	APVMA - Currently under review Europe – deregistered Rotterdam Convention - nominated	
PLANT GROWTH REGULATORS				
Plant growth regulators	Ethephon (PER14966)			

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