# Pineapple

## Strategic Agrichemical Review Process (SARP)

## April 2019

Hort Innovation
Project - MT18007

**Hort Innovation Project Number:**
MT18007 – Melon & Pineapple Industry SARP Report Updates

**SARP Service Provider:**
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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 pineapple industry across Australia. The information in this report will assist the industry with its agrichemical selection and usage into the future.

**Date of report:**
15 April 2019

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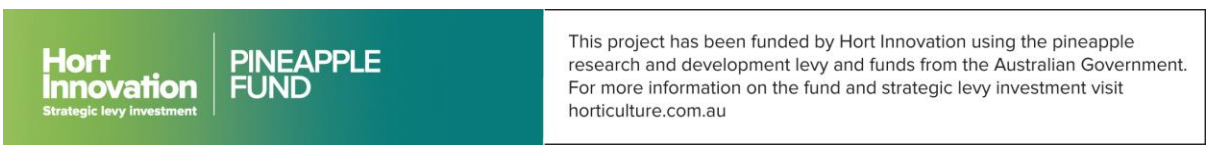

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# 1. Summary

The strategic levy investment project Melon & Pineapple Industry SARP Report Updates (MT18007) is part of the Hort Innovation Pineapple 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 pineapple 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 |
|---|---|
| Root and heart rot | *Phytophthora cinnamomi & P. nicotianae* |

## 1.2 Insects, mites and other invertebrates

The high priority insect, mite and other invertebrate pests are:

| Common Name | Scientific Name |
|---|---|
| Root knot nematode and Root lesion nematode | *Meloidogyne spp.& Pratylenchus spp.* |
| Pineapple flat (red) mite | *Dolichotetranychus floridanus* |
| Symphylids | Scutigerella spp, Hanseniella spp |
| Pineapple mealybugs | *Pseudococcus spp. & Dysmicoccus brevipes* |
| White grubs | *Scarabaeidae* |

## 1.3 Weeds

The high priority weeds are:

| Common Name | Scientific Name |
|---|---|
| Blue billygoat weed (Bluetop) | *Ageratum houstonianum* |
| Billy goat weed (Bluetop) | *Ageratum conyzoides* |
| Praxelis | *Praxelis clematidea* |
| Pigweed | *Portulaca oleraces* |

In addition to the above weeds respondents nominated a range of other weeds as priority gaps in the pest control strategy. The additional high priority nominations were Carrot weed, Nutgrass, Pretty boy and Thickhead. However, it is difficult to assess how important these pests are across the broader industry.

## 1.4 Plant growth regulation

The critical importance of plant growth regulators to the pineapple industry for the initiation of flowering, fruit ripening and to increase the multiplication rate of planting material was re-enforced.

# 2. The Australian Pineapple Industry

The pineapple industry is a large tropical fruit industry. Pineapples are available year-round, with 99% of the crop grown in Queensland with the major growing regions in Mareeba (North Queensland), Yeppoon, Bundaberg (Central Queensland) and the Sunshine Coast. Whilst Queensland remains the largest production region, the Northern Territory has increased its production in recent years. The Australian pineapple industry is predominantly made up of growers whose families have been growing pineapples for generations. There are three major pack houses/marketing groups, each with a number of growers supplying them directly.

Pineapples are available throughout the year due to a wide number of varieties and Australia's varying weather conditions.

## Fresh Pineapple Seasonality by State

| State | 17/18 Tonnes | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Queensland | 75,242 | | | | | | | | | | | | |
| Northern Territory | 760 | | | | | | | | | | | | |
| Availability legend | | | High | | | Medium | | | Low | | | None | |

*Source: (Freshlogic Analysis); QDAF*

The industry has moved from one where the majority of fruit was grown for processing to one that is moving towards supplying the fresh market due to the increased competition from cheaper imports of processed fruit. In 2017/18, 76,002 tonnes of pineapples were produced, with a production value of $53.4 million. Some 47,206 tonnes (62%) of pineapples were sent to the fresh market in 2017/18, with the remaining 28,796 tonnes (38%) being sent to be processed. The pineapple processing sector has experienced gradual decline in recent years; approximately 45% of total production volume (36,516 tonnes) was sent for processing in 2014/15. In 2017/18, 19,495 tonnes of preserved/dried pineapples were imported, valued at $31.3 million; fresh pineapples were not imported. By comparison the export of preserved/dried pineapple in 2017/18 was very small (126 tonnes); fresh pineapples were not exported in any significant quantity.[1]

Opportunities to extend the current production are limited with many in the southern growing regions now at full capacity on their available land. Expansion would require the purchase of expensive land, scale up of associated production capacity and labour. Labour represents the highest proportion of production costs. Faced with increasing imports, the focus would continue to be planting the newer varieties to supply the fresh market.[2]

[1] Hort Innovation (2019). Australian Horticulture Statistics Handbook 2017/18. [online] Available at: https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/australian-horticulture-statistics-handbook/

[2] Hort Innovation (2017). Pineapple Strategic Investment Plan (2017-2021). [Online] Available at: https://www.horticulture.com.au/hort-innovation/funding-consultation-and-investing/investment-documents/strategic-investment-plans/

# 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 pineapple 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 pineapple industry regarding pesticide access, Hort Innovation undertook a review of the pesticide requirements via a Strategic Agrichemical Review Process (SARP) in 2013. 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 pineapple 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 pineapple 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 pineapples 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 Pineapple Industry in consultation with industry, government and scientists. The Biosecurity Plan for the Pineapple Industry 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: http://www.planthealthaustralia.com.au/industries/pineapples/

## 3.2 Minor use permits and registration

From a pesticide access perspective, the APVMA classifies pineapples as a major crop. The crop fits within the APVMA Crop Group 006: Assorted tropical and sub-tropical fruits – inedible peel. 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 pineapple industry is for manufacturers to register new pesticide uses in the crop.

## 3.3 Methods

The current update of the pineapple Strategic Agrichemical Review Process (SARP), which was last updated in 2013, 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.<br>Survey released: 25 January 2019<br>Survey extended: 28 February 2019<br>Survey closed: 11 March 2019 |
| SARP data updated via a desktop audit | Updated registrations and permits<br>Updated MRL tables<br>Updated available and potential pesticides against low, moderate and high priority pests, including an assessment of their suitability<br>Included information on regulatory risks |
| Captured industry input | Collated and analysed survey results<br>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 pineapple
Appendix 2. Products available for control of insects, mites and other pests in pineapple
Appendix 3. Products available for weed control in pineapple
Appendix 4. Current permits for use in pineapple
Appendix 5. Pineapple Maximum Residue Limits (MRLs)
Appendix 6. Pineapple regulatory risk assessment

# 4. Diseases, pests and weeds of pineapples

Pineapple has a 3-4 year growing period for 2 crop cycles, the plant crop and the ratoon. The long growing cycle can increase the difficulty of dealing with some pests and weeds as noted in the relevant sections. It also adds to the cost of conducting trials (e.g. residue trials).

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). If treated fruit is to be exported nil residues at harvest would be needed for these options.

While care has been taken to ensure the accuracy of the information provided in this document the APVMA registered label and where relevant the APVMA approved permit must always be followed.

## 4.1 Diseases of pineapples

### 4.1.1 Disease priorities

| Common name | Scientific name |
|---|---|
| **High** | |
| Root and heart rot | *Phytophthora cinnamomi & P. nicotianae* |
| **Moderate** | |
| Base (Butt) rot | *Chalara paradoxa* |
| Water blister | *Thielaviopsis paradoxa* |
| **Low** | |
| Bacterial soft rot bacteria (causing urea burn syndrome) | *Erwinia* spp. |

**Bacterial heart rot and fruit collapse of pineapple (*Dickeya zeae*)**
This disease was reported in the current consultation as a high priority, where present. Recently detected in Queensland and the Northern Territory, Bacterial heart rot and fruit collapse of pineapple are 2 separate diseases caused by a single species of bacteria belonging to the *Dickeya* spp. complex (formerly *Erwinia chrysanthemi*). In Queensland, the diseases are caused by the species *Dickeya zeae*. Monitor for symptoms in the central whorl of leaves in young plants or soft rot on mature fruit of pineapple. If you see symptoms consistent with bacterial heart rot/fruit collapse call the Exotic Plant Pest Hotline on 1800 084 881 or Biosecurity Queensland 13 25 23.

**Further information is available at:** https://www.daf.qld.gov.au/business-priorities/biosecurity/plant/health-pests-diseases/a-z-list-of-emergency-plant-pests-and-diseases/bacterial-heart-rot-and-fruit-collapse-of-pineapple

**Resistance Management**
There is one relevant specific management strategy for management of postharvest diseases in fruit for Group 2 (Dicarboximide); and other "systemic" fungicides; Group 3 (DMI); Group 9 (Anilinopyrimidine) fungicides; and Group 12 (Phenylpyrroles) fungicides. Primarily this strategy is to avoid using the same group post-harvest as the last pre-harvest application; rotate mode of action where options are available; and to avoid the disposal of unused dip solutions on, in or near the crop.
https://www.croplife.org.au/resources/programs/resistance-management/fruit-post-harvest-diseases-3/

## 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 |
|---|---|---|---|---|---|---|---|
| **Root and heart rot** (*Phytophthora cinnamomi* & *P. nicotianae)*<br>**Priority: High** | | | | | | | |
| Phytophthora is a microscopic, soil borne organism that attacks the roots and basal stem tissue of plants. Plants at all growth stages can be affected but 3-4-month-old plantings are most susceptible. | | | | | | | |
| Dazomet (Cerlong) | - | Soil fumigant | NR | A | ALL | Registered in broadacre seed beds for control of soil fungi (including ***Phytophthora* spp.**), nematodes (cyst and non-cyst forming), soil insects and germinating seeds of weeds. [Users may require fumigator license] | - |
| Fosetyl (Nobility) | 33 | Systemic fungicide | 7 | A | Qld, NSW, WA only | Registered as a soil drench and foliar spray in pineapples for control of ***Phytophthora* root and heart rot**. In the original SARP growers considered the product too expensive and no better than phosphorous acid, thus not widely used.<br>[soil drench + foliar appl'ns with Re-treatment interval: 6 weeks from late summer to early winter] | - |
| Metalaxyl (Zeemil) | 4 | Systemic fungicide | 28 | A | ALL | Registered as a soil drench and foliar spray in pineapples for control of ***Phytophthora* root and heart rot**. [immediately after planting; Re-treatment interval: 4-8 weeks summer, autumn and winter] | - |

| Disease / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Regulatory risk |
|---|---|---|---|---|---|---|---|
| Metalaxyl-M (Ridomil) | 4 | Systemic fungicide | 28 | A | ALL | Registered as a soil drench and foliar spray in pineapples for control of ***Phytophthora* root and heart rot**. The original SARP reported that it is very effective after many years of use; that generic products are widely used; and that potential issues with resistance are occurring. [immediately after planting; Re-treatment interval: 4-8 weeks summer, autumn and winter] | - |
| Metham sodium (Metham) and potassium formulated variant | - | Soil fumigant | NR | A | ALL | Registered for control of nematodes, germinating weed seeds (including fat hen), symphylids (not TAS) and fungus diseases (including ***Phytophthora***) field application in beds or rows. Field application to total area NSW, QLD, SA, VIC, WA only. Considered a weak nematicide but a good fungicide. [Users may require fumigator license] | - |
| Phosphorous acid (Agri-Fos) | 33 | Protective & Curative | NR | A | Qld, WA only | Registered as a foliar spray in pineapples for control of ***Phytophthora* root and heart rot**. Apply to tops two weeks prior to harvest of planting material. Very effective. Reported in the original SARP to be widely used and IPM compatible. [one application to tops 2 weeks prior to harvesting of planting material] | - |
| Phosphorous acid PER83873 | 33 | Protective | NR | A | NSW, Qld, WA & NT only | PER83873 for use in pineapple planting material (pre-plant dip) for control of ***Phytophthora* heart and root rot**. Data generated by project PI12006. [Max 1 appl'n; pre-plant dip] | - |
| Oxathiapiprolin + azoxystrobin (Orondis Flexi) | 49 + 11 | | | P | | New product (Syngenta) under evaluation by APVMA for control of certain foliar diseases on vegetables and poppies. Indications of strong activity on Phytophthora. | - |
| Cyazofamid (Ranman) | 21 | Protectant | | P | | Not currently registered in pineapples. Registered in a number of crops including potato for control of late blight (*Phytophthora infestans*). There may be potential for a label extension to include pineapple. | - |
| Azoxystrobin (Amistar) | 11 | Protective & Curative | | P | | Not currently registered for use in pineapples. Registered for various crops and diseases including in potato and tomato for late blight (*Phytophthora infestans*). Good IPM fit. May be an alternative option to the Group 49 + Group 11 product above. | - |

| Disease / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Regulatory risk |
|---|---|---|---|---|---|---|---|
| Mandipropamid (Revus) | 40 | | | P | | Not currently registered in pineapples. Registered in a number of crops in Australia for control of downy mildew. The US label for Revus includes a number of *Phytophthora* spp. in several crops, though NOT the disease agents of root and heart rot. It may be worth investigating this product. | |
| Captan | M4 | Protective & Curative, non-systemic | | P | | Not currently registered for use in pineapples. Registered for various crops and diseases including in potato and tomato for late blight (*Phytophthora infestans*). May be an alternative option for use in pineapples. | - |
| **Base rot or Water blister** (*Ceratocystis paradoxa* asexual name *Chalara paradoxa* or *Thielaviopsis paradoxa)* – Plant establishment disease (Base rot) and Post harvest disease (water blister)<br>**Priority**: Moderate | | | | | | | |
| Base rot is a grey to black rot of the soft butt tissue that leaves a cavity and stringy fibres at the base of the stem. Symptoms can be seen on crowns, slips and suckers before or immediately after planting. Plants may fail to establish.<br><br>Water blisters consist of a soft, watery rot of the fruit flesh with overlying skin glassy, water-soaked and brittle. Eventually, the skin, flesh and core disintegrate and the fruit dries out, leaving an empty fruit carcass containing a few, black vascular fibres. The fungus enters the fruit through wounds and the crevices between individual fruits. | | | | | | | |
| Iodine (AIS Iodine Granules) | - | Fungicide / bactercide | NR | A | ALL | Registered as a post harvest treatment – **sanitiser against rots and moulds**. Commonly used in packing house water bath treatment. | - |
| Prochloraz (Sportak) | 3 | Protective and curative | NR | A | Qld, NSW, WA only | Registered as a post-harvest dip for control of **water blister** in pineapple. | - |
| Propiconazole (various) | 3 | Protective and curative | NR | A | Qld, NT, WA only | Registered in pineapple planting material (pre-plant dip) for control of **base rot** *(Thielaviopsis paradoxa).* | R3 |

| Disease / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Regulatory risk |
|---|---|---|---|---|---|---|---|
| **Bacterial soft rot bacteria (causing urea burn syndrome in pineapple)** *Erwinia* spp.<br>**Priority:** Low | | | | | | | |
| Bacterial soft rots can be caused by a genus of bacterial isolates (*Erwinia* spp.). These can cause urea burn syndrome in pineapples and this was raised as a moderate issue in the original SARP. It was not raised as a priority by growers in the current consultation. In general, sanitary growing practices are the primary management approach for bacterial soft rots. However, the specific issue reported in the original SARP was the breakdown of urea to ammonia in urea foliar fertiliser sprays leading to urea burn and blister. The original report noted that disinfectants were commonly used to treat water used for foliar fertiliser applications but also that fewer growers were using urea as a foliar fertiliser. There do not appear to be any registered disinfectants with specific claims for this problem. In the past, permits for two specific Quaternary Ammonium Compound products were approved for bacteria (urea heart rot) in pineapples. There are no current permits. | | | | | | | |

## 4.2 Insect, mite and other pests of pineapples

### 4.2.1 Insect, mite and other pest priorities

| Common name | Scientific name |
|---|---|
| **High** | |
| Root knot nematode and Root lesion nematode | *Meloidogyne spp.& Pratylenchus spp.* |
| Pineapple flat (red) mite | *Dolichotetranychus floridanus* |
| Symphylids | Scutigerella spp, Hanseniella spp |
| Pineapple mealybugs | *Pseudococcus spp. & Dysmicoccus brevipes* |
| White grubs | *Scarabaeidae* |
| **Moderate** | |
| African black beetle | *Heteronychus arator* |
| Ants | *Formicidae* |
| Rutherglen bug | *Nysius vinitor* |
| **Low** | |
| Armyworm | *Spodoptera* spp. |
| Pineapple scale | *Diaspis bromeliae* |
| Fruit flies | *Bactrocera* spp. |

Pineapple has a 3-4 year growing period for 2 crop cycles, the plant crop and the ratoon. The very long cropping cycle increases the difficulty in dealing with some pests that can be more easily addressed during inter-crop periods, such as nematodes, mealybugs and mice.

The available options for nematodes and rats/mice have been added to this section.

**Grey mealybug (*Dysmicococcus neobrevipes*) and Tecla moth (*Strymon megarus*)**
The Grey mealybug and the Tecla moth (or pineapple fruit borer), both raised as risks in the original SARP, are exotic to Australia. Details of the pineapple biosecurity plan, that includes risk mitigation and contingency plans, are included in section 3.1.

**For further information and fact sheets on these two exotic pests:**
http://www.planthealthaustralia.com.au/industries/pineapples/

Resistance Management
There are no specific CropLife resistance management strategies for pineapple/insect combinations.

## 4.2.2 Available and potential products for priority insects, mites and other invertebrates

**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 |
|---|---|---|---|---|---|---|---|---|
| **Root knot nematode** *(Meloidogyne* spp.*)* and **Root lesion nematode** *(Pratylenchus* spp.*)*<br>**Priority**: High | | | | | | | | |
| Root-knot nematode cause distinct swellings on the roots. The root lesion nematode develops brown lesions on the roots, which may girdle the roots and cause their premature death. "Pineapple has a 3-4 year growing period for 2 crop cycles. The only defense for nematodes is soil fumigation. We have nothing we can apply over plants for nematode control since the removal of Nemacur" | | | | | | | | |
| 1,3-dichloropropene (Tri-Form) | - | Soil fumigant | NR | A | ALL (Restricted use TAS, VIC, SA) | Registered in field crops for control of **plant parasitic nematodes**. Restricted chemical. Commonly used option (original SARP data). [Users may require fumigator license] | - | - |
| Chloropicrin (formulated with 1,3-dichloropropene as Tri-form) | 8B | Soil fumigant | NR | A | ALL (Restricted use TAS, VIC, SA) | Registered in various crops including vegetables for control of **plant parasitic nematodes**, symphylans, wireworms, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. [Users may require fumigator license] | - | - |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| Dazomet (Cerlong) | - | Soil fumigant | NR | A | ALL | Registered in broadacre seed beds for control of soil fungi (including *Phytophthora* spp.), **nematodes (cyst and non-cyst forming)**, soil insects and germinating seeds of weeds. [Users may require fumigator license] | - | - |
| Metham sodium (Metham) and potassium formulated variant | - | Soil fumigant | NR | A | ALL | Registered for control of **nematodes**, germinating weed seeds (including fat hen), symphylids (not TAS) and fungus diseases (including *Phytophthora*) field application in beds or rows. Field application to total area NSW, QLD, SA, VIC, WA only. [Users may require fumigator license]. Considered a weak nematicide (original SARP data). | - | - |
| Fluensulfone (Nimitz 480 EC) | - | Contact | | P | | Registered in a number of vegetable crops for control of root-knot nematode and in sugar cane for both root-knot (*Meloidogyne* spp.) and root lesion (*Pratylenchus zeae*) nematode. A screening trial has been commissioned by Adama – there is interest to add this crop and use. For the long pineapple growing period in-crop treatments are required. | - | - |
| Fluopyram (registered overseas as Velum) | 7 | Protective, systemic, curative fungicide and nematicide | | P | | Nematicide product by Bayer registered overseas as Velum - for the control of root-knot nematode (Meloidogyne spp.), lesion nematode (Pratylenchus spp.) and spiral nematode (Helicotylenchus spp.) in tomatoes, root knot nematode (Meloidogyne spp.) in potatoes and tobacco as well as early blight (Alternaria solani) in potatoes.<br><br>Potential for use in pineapples as a foliar/soil post-planting/ratoon. 1-3 applications prior to induction for plant crops. 1-2 applications prior to induction for ratoon. 2019 - ST18001 – Grant funded project pending. | | - |
| Abamectin (Tervigo) | 6 | Contact and stomach | | P | | Not registered for use in pineapples. Registered in a number of vegetable crops for control of root-knot nematode (*Meloidogyne* spp.) as a plant hole drench or applied through the irrigation system. | M | - |
| Fluazaindolizine | - | - | | P | | New nematicide by DuPont that is not registered in Australia, EU or USA. The potential use pattern is not yet known. | | - |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| **Pineapple flat (red) mite** – *Dolichotetranychus floridanus*<br>**Priority**: High | | | | | | | | |
| Flat mite can cause significant problems with establishment and early growth. Flat mite colonies can develop rapidly, and are clearly visible as reddish/orange blotches on the soft white basal tissue of leaves. As damaged leaves continue to grow, feeding sites appear as multiple indentations on the green leaf. Severe infestations produce large, dark brown lesions that almost cover the basal white tissue which can lead to necrosis and death of the leaves. Populations develop quickly under hot, dry conditions. | | | | | | | | |
| Abamectin PER81805 | 6 | Contact and stomach | 112 | A | NT & Qld only | PER81805 for use in pineapple for control of **pineapple flat mite**. [max 2 appl'ns per season] | M | - |
| Dimethoate PER87066 Version 1 | 1B | Contact and systemic | H:35 G:35 | A | ALL | PER87066 for use in pineapples for control of **pineapple red mite & flat mite**. [max 12 appl'ns per year] | H | R3 |
| Ethyl formate (Vapormate) | - | Fumigant | NR | A | ALL | Registered as a post-harvest fumigant in pineapples for control of **mites**, mealybugs, and scale. | | - |
| Spiromesifen | 23 | | | P | | A new product from Bayer may be a potential option. Spiromesifen is not yet approved for use in Australia. It has been registered in the USA for some time (Oberon). US labels include uses on fruiting vegetables, leafy vegetables, corn, low growing berries, brassica leafy vegetables and tuberous and corm vegetables for the control of various mites: e.g. Spider (including two-spotted spider mite) and tarsonemid (including broad mite); and also whiteflies (including greenhouse and silverleaf) – not all pests on all crops, see US labels. | | - |
| Etoxazole (Paramite) | 10B | | | P | | Not registered for use in pineapples. Registered for various mites in bananas, citrus, pome and stone fruit, grapes, tomatoes, capsicum, cotton, almonds and turf. (Sumitomo). Potential for a label extension. | L | - |
| SYNFOI21 | TBC | | | P | | A new product from Syngenta coded SYNFOI21 may be a potential option for control of pineapple red (flat) mite. A new mode of action – chemical class - with activity on various bugs and thrips. The product is expected around 2022-23. | | - |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| **Symphylids** – *Scutigerella spp, Hanseniella* spp.<br>**Priority**: High | | | | | | | | |
| Symphylids are small white-cream coloured insects, typically 1 cm in length with 2 long antennae. Symphylids eat the roots of plants often leading to it being killed or causing multiple branching and the 'witches broom' effect. Control is generally required in the season prior to planting or just prior to planting the crop as in-crop control is more difficult and less effective. Several respondents highlighted the issue of soil insects: symphylids and white grubs; control costs and the only post-plant option for symphylids of bifenthrin. The use of bifenthrin for this pest is now registered – data generation was supported with Hort Innovation project PI10003. Alternate options are needed. | | | | | | | | |
| 1,3-dichloropropene + Chloropicrin (Tri-Form) | - | Soil fumigant | NR | A | ALL (Restricted use TAS, VIC, SA) | Registered in various crops including vegetables for control of plant parasitic nematodes, **symphylans**, wireworms, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. [Users may require fumigator license] | - | - |
| Bifenthrin (Astral) | 3A | Systemic | H:90<br>G:42 | A | Qld only | Registered in pineapples for control of **symphylids**. Commonly used option (original SARP data).<br>[max no. of applications is not specified; instructions and Re-treatment interval for plant and ratoon crops are specified] | VH | R3 |
| Metham sodium (Metham) and potassium formulated variant | - | Soil fumigant | NR | A | Not TAS | Registered for control of nematodes, germinating weed seeds (including fat hen), **symphylids (not TAS)** and fungus diseases (including *Phytophthora*) field application in beds or rows. Field application to total area NSW, QLD, SA, VIC, WA only. [Users may require fumigator license] | - | - |
| **Pineapple Mealybug** – *Pseudococcus spp. & Dysmicoccus brevipes*<br>**Priority**: High | | | | | | | | |
| Major pests in most areas. Pineapple mealybug can be important as they can be involved in the transmission of wilt disease. Form a symbiotic relationship with ants as they benefit from the production of mealybug honeydew. | | | | | | | | |
| Chlorpyrifos (various) | 1B | Contact/ systemic | NR | A | Qld, WA only | Registered in pineapples for control of **pineapple mealybug**, ants and white grubs. Commonly used option (original SARP data). Given the uncertainty over the future of chlorpyrifos uses, alternatives should be sought.<br>[Re-treatment interval: 90 d (mealy bug and ants); max no. of appl'ns not specified; white grub – single pre-plant appln]. | H | R2 |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| Diazinon (Accensi) | 1B | Contact/ systemic | H:14 G:14 | A | Qld, NSW, WA only | Registered in pineapples for control of pineapple scale and **mealybug**. Very effective when applied regularly. Will knock out some predatory mites. Commonly used option (original SARP data). [max no. of appl'ns not specified] | H | R3 |
| Ethyl formate (Vapormate) | - | Fumigant | NR | A | ALL | Registered as a post-harvest fumigant in pineapples for control of mites, **mealybugs**, and scale. | - | - |
| Potassium salts of fatty acids (Natrasoap) | - | Contact | Nil | A | ALL | Registered in all outdoor fruit plants for control of aphids, thrips, **mealybug**, two-spotted mites, spider mite, and white fly. [Re-treatment interval: 5-7 d; max no. of appl'ns not specified] | - | - |
| Spirotetramat (Movento) PER81900 | 23 | Stomach | H:14 G:Nil | A | Qld & NT only | PER81900 for use in pineapple for suppression of **pineapple mealybug**. Hort Innovation project ST16006 is working with Bayer toward a label registration for mealybug + Scale. [max 2 (non-consecutive) appl'ns per crop] | M | - |
| Sulfoxaflor (Transform) PER81901 | 4C | Contact and systemic | H:14 G:NR | A | Qld & NT only | PER81901 for use in pineapple for control of **pineapple mealybug**. [max 2 (non-consecutive) appl'ns per crop] | M<br>VH - bees | - |
| Acetamiprid + Pyriproxyfen (Trivor) | 4A + 7C | | | P | | Not registered in pineapples. Registered in citrus for control of red scale, pink wax scale, black scale and suppression of citrus mealybug. As part of Hort Innovation project ST16006 work is underway toward a tropical fruit (inedible peel) group registration for scales and various bugs. | M<br>VH - bees | - |
| Buprofezin (Applaud) | 16 | Insect growth regulator | | P | | Not currently registered in pineapples. Registered in citrus, grapes, pears, persimmons, custard apples, passionfruit, mangos, tomato for control of various combinations of: scale (including red scale, white louse scale), jassids, mealybugs (including longtail, citrus and citrophilous) - refer to label. May have potential for a label extension to pineapple. | - | - |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| Flonicamid (Mainman) | 9C | Systemic | | P | | Not currently registered in pineapples. Registered pome fruits, cotton, cucurbits and potatoes for control of combinations of green peach aphid, melon aphid, potato aphid, woolly apple aphid, green mired, lontailed mealybug (*pseudococcus longispinus*), tuber mealybug (*pseudococcus viburni*) and silverleaf whitefly. Potential for a label extension. | M | - |
| **White Grub** – *Scarabaeidae*<br>**Priority**: Moderate | | | | | | | | |
| The original SARP evaluated white grubs as a major problem – nth Qld, Moderate- sporadic / epidemic problem – SE Qld. When they occur, they can be in very large numbers. White grubs are the larvae of various scarab beetles. They feed on the roots of crops and cause significant damage – stunting and death. White grubs populations are difficult to determine during the crops as they are only found in the soil under plants. Control is generally required in the season prior to planting or just prior to planting the crop as in-crop control is more difficult and less effective. | | | | | | | | |
| Chlorpyrifos (various) | 1B | Contact/ systemic | NR | A | Qld only | Registered in pineapple for control of ants, mealybugs, pineapple scale and **scarab larvae (white grub)**. Commonly used option (original SARP data). Given the uncertainty over the future of chlorpyrifos uses, alternatives should be sought.<br>[Re-treatment interval: 90 d (mealy bug and ants); max no. of appl'ns not specified; white grub – single pre-plant appln] | H | R2 |
| Tetraniliprole (Vayego)<br>DC-163 | 28 | | | P | | A new pesticide by Bayer. Not yet registered in Australia, USA or EU. Applications in progress for Australian registrations. Hort Innovation Project ST17000 underway with Bayer - seeking registration for control of soil insects including white grub and *Scarabaeidae spp.* Project ST17000 to assist in generating residue and crop safety data in pineapples – estimated data completion 30 Nov 2020. | L-M | - |
| Clothianidin (Samurai) | 4A | | | P | | Not registered for use in pineapple. Registered in pome fruits, stone fruits, citrus and grapes for the control of a variety of insect pests. US label (Arena) includes control of a number of white grubs on ornamental plants. May be a potential option for a label extension to pineapples. | M<br><br>VH - bees | - |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| **African black beetle** – *Heteronychus arator*<br>**Priority**: Moderate | | | | | | | | |
| Larvae are creamy white with a brown head capsule and dark hind segments. Adults are 12-15 mm long shiny black beetles. The adult is considered the main pest stage causing chewing damage to a wide variety of plants. There do not appear to be any currently registered options for this pest however some applications targeting other pineapple pests such as white grub and symphylids are likely to effect some control. | | | | | | | | |
| Tetraniliprole (Vayego) DC-163 | 28 | | | P | | A new pesticide by Bayer. Not yet registered in Australia, USA or EU. Applications in progress for Australian registrations. Could be investigated for activity on this pest. Seeking registration with Bayer for control of soil insects including white grub and *Scarabaeidae spp.* Project ST17000 to assist in generating residue and crop safety data in pineapples for white grub – estimated completion 30 Nov 2020. Note: project ST17000 is also collecting data for a label registration in potato for control of African black beetle | L-M | - |
| SYNFOI21 | TBC | | | P | | A new product from Syngenta coded SYNFOI21 may be a potential option for control of African black beetle. A new mode of action – chemical class - with activity on various bugs and thrips. The product is expected around 2022-23. | | - |
| Clothianidin (Samurai) | 4A | | | P | | Not registered for use in pineapple. Registered in pome fruits, stone fruits, citrus and grapes for the control of a variety of insect pests. Registered in turf for the control of African Black beetle. May be a potential option for a label extension to pineapples. | M<br>VH - bees | - |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| **Ants** – *Formicidae*<br>**Priority**: Moderate [a pest of significant importance to many growers however not specified as a high priority gap in the pest control strategy] | | | | | | | | |
| Ants are considered a major pest problem in pineapples because of their tendency to promote the proliferation of honeydew producing insects like mealybug and soft scale which can result in serious damage to crops. They vary in size according to species and some of the larger species are known to cause issues in ground stability. | | | | | | | | |
| Chlorpyrifos (various) | 1B | Contact/ systemic | NR | A | Qld, WA only | Registered in pineapples for control of pineapple mealybug, **ants** and white grubs. Commonly used option (original SARP data). Given the uncertainty over the future of chlorpyrifos uses, alternatives should be sought.<br>[Re-treatment interval: 90 days (mealy bug and ants), max no. of appl'ns not specified; white grub – single pre-plant appl'n] | H | R2 |
| Pyriproxyfen (Distance) | 7C | Bait | NR | A | ALL | Registered as a bait for tropical fruit cropping areas for control of **invasive and nuisance ants**. Do not apply directly to crop plants.<br>[Re-treatment interval: 3 months; max 3 appl'ns per year] | VL | - |
| Hexaflumuron (sentricon) | 15 | | | P | | Registered in Australia and overseas for the control of termites. Has been proposed as a potential option through the AgChem forum for use against ants in other tropical / exotic fruits | | - |
| Hydramethylnon (Amdro) | 20A | | | P | | Not registered for use in pineapples or any other food crops. Registered in Australia for control of a range of ants in a range of garden and amenity situations. (BASF) | | - |
| Hydramethylnon + pyriproxifen (Synergy) | 7C + 20 | | | P | | Not registered for use in pineapples or any other food crops. Registered in Australia for various nuisance and tramp ants in a range of domestic, public service, commercial, and industrial areas; forests and non-crop areas. (Sumitomo) | | - |
| Bifenthrin (Talstar) | 3A | | | P-A | | Not registered for use in pineapples. Registered in Australia as a ready to use domestic surface spray against various nuisance pests including ants. | H | R3 |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| **Rutherglen bug** – *Nysius vinitor*<br>**Priority**: Moderate | | | | | | | | |
| Rutherglen bugs are sucking insects, adults and nymphs feed on sap generally from stems, leaves and flowers. Breeding on native and weed hosts they can migrate into crops in large numbers. The control of weed hosts can be important. There do not appear to be any currently registered options for this pest in pineapples, however applications targeting other pineapple pests are likely to effect some control. | | | | | | | | |
| Acetamiprid + emamectin (skope) | 4A + 6 | | | P | | The suggested product is registered in cotton for control of silver leaf whitefly, green mired, green vegetable bug, cotton bollworm, native budworm, cotton aphid. The actives are registered separately in various crops. Relatively poor for use in IPM programs. | M<br>VH - bees | - |
| Dinetofuran (starkle) | 4A | | | P | | Not currently registered in pineapples. Australian registrations include the control of silverleaf whitefly, green mirid and green vegetable bug on cotton and green mirids on mung beans. May have potential for further investigation to use in pineapple for Rutherglen bug. | M<br>VH - bees | - |
| Petroleum oil (various) | - | Contact | | P | | Potential soft option. Currently permitted on various specified vegetable crops (PER12221) for a range of insect pests including Rutherglen bug. | VL | - |
| Sulfoxaflor (Transform) | 4C | Contact and systemic | | P-A | | Currently permitted in pineapples for control of mealy bug (PER81901). May be an option for use against Rutherglen bug. | M<br>VH - bees | - |
| SYNFOI21 | TBC | | | P | | A new product from Syngenta coded SYNFOI21 may be a potential option for control of Rutherglen bug. A new mode of action – chemical class - with activity on various bugs and thrips. The product is expected around 2022-23. | | - |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| **Army Worm** – *Spodoptera* spp.<br>**Priority**: Low | | | | | | | | |
| Generally eggs are laid on the undersides of leaves in the lower canopy. Hatched larvae forage in groups, feed at night and pupate in the soil. | | | | | | | | |
| *Bacillus thuringiensis* subsp. *kurstaki* (Dipel) | 11A | Ingestion | NR | A | ALL | Registered in fruits for control of **Armyworm (*Spodoptera* spp.),** cotton bollworm, native budworm, cabbage moth, cabbage white butterfly, green looper, lightbrown apple moth, pear looper, soybean looper, vine moth, and tobacco looper. IPM friendly. [max no. of appl'ns not specified] | VL | - |
| Emamectin benzoate (proclaim opti) | 6 | | | P | | Not registered for use in pineapples or for this pest in other crops. Registered in various vegetable, root and tuber, and strawberry crops for control of cluster caterpillar (*Spodoptera litura*). May be a potential option for use against army worm in pineapples. | M | - |
| Indoxacarb (Avatar) | 22A | | | P | | Not registered for use in pineapples or for this pest in other crops. Registered in broccoli, brussel sprouts, closed head cabbage and cauliflower for control of cluster caterpillar (*Spodoptera litura*). May be a potential option for use against army worm in pineapples. | L | - |
| Spinetoram (Success Neo) | 5 | Contact and ingestion | | P | | Not registered for use in pineapples or in other crops for this pest. Registered in a number of crops for pests including cluster caterpillar (*Spodoptera litura*). Registered in tropical and sub-tropical fruits (inedible peel) as specified, for a number of pests including Flower-eating caterpillars, Leafrollers and loopers, Yellow peach moth, Red-banded thrips and Sorghum head caterpillar. A Group MRL is established. May be a potential option for a label extension for army worm in pineapples. | - | - |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| **Pineapple scale** – *Diaspis bromeliae*<br>**Priority**: Low | | | | | | | | |
| Found on the upper leaf surfaces and fruit. They secrete a waxy coating for defense that causes them to resemble reptilian/fish scales. A symptom of attack is rust coloured spots. | | | | | | | | |
| Chlorpyrifos (various) | 1B | Contact/ systemic | NR | A | Qld only | Registered in pineapple for control of ants, mealybugs, **pineapple scale** and scarab larvae (white grub). Given the uncertainty over the future of chlorpyrifos uses, alternatives should be sought. [max no. of appln's not specified] | H | R2 |
| Diazinon (Accensi) | 1B | Contact/ systemic | H:14 G:14 | A | Qld, NSW, WA only | Registered in pineapples for control of **pineapple scale** and mealybug. Very effective when applied regularly. Will knock out some predatory mites. Commonly used option (original SARP data). [max no. of appl'ns not specified] | H | R3 |
| Ethyl formate (Vapormate) | - | Fumigant | NR | A | ALL | Registered as a post-harvest fumigant in pineapples for control of mites, mealybugs, and **scale**. | - | - |
| Acetamiprid + Pyriproxyfen (Trivor) | 4A + 7C | | | P | | Not registered in pineapples. Registered in citrus for control of red scale, pink wax scale, black scale and suppression of citrus mealybug. As part of Hort Innovation project ST16006 work is underway toward a tropical fruit (inedible peel) group registration for scales and various bugs. | M<br>H-bees | - |
| Paraffinic oil (Biopest) | - | Contact | | P | | Not registered for use in pineapples. Registered for control of scale insects in other tropical fruits. This may be a potential soft option for a label extension to pineapple. | VL | - |
| Spirotetramat (Movento) | 23 | Stomach | | P-A | | Not registered for use in pineapples. PER81900 allows use in pineapple for suppression of pineapple mealybug. Registered in other crops for various mealybug and scale pests. Hort Innovation project ST16006 is working with Bayer toward a label registration for mealybug + Scale. | M | - |
| Sulfoxaflor (Transform) | 4C | Contact and systemic | | P-A | | Not registered for use in pineapples. Currently permitted in pineapples for control of mealy bug (PER81901). It is registered in citrus for Citricola scale, Pink wax scale, Citrus snow (white louse) and Red scale. May be worth investigating use against Pineapple scale. | M<br>VH-bees | - |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| **Fruit flies** – *Bactrocera* spp.<br>**Priority**: Low | | | | | | | | |
| Fruit fly damage starts when the female fruit fly punctures the fruit with its long and sharp ovipositor. The fruit will start to decay with invading bacteria and the larvae feed on the decaying tissue. Queensland fruit fly (*Bactrocera tryoni* ) is a significant pest on a range of crops with a large geographic spread through parts of NT, QLD, NSW and VIC. It has a broad host range of fruits and vegetables. Perimeter protein bait spraying and male annihilation technique have shown positive results in vegetable crops but are not sufficient in that situation where populations are high [refer to Hort Innovation vegetable project VG13041]. Broad spectrum insecticides like dimethoate and trichlorfon will kill natural enemies. | | | | | | | | |
| Dimethoate PER13859 | 1B | Contact and systemic | NR | A | ALL | PER13859 for use in orchard clean up of **fruit fly host crops** after harvest. | H | R2 |
| Trichlorfon PER12450 | 1B | Contact and stomach | 7 | A | ACT, NSW, NT, QLD, SA and WA | PER12450 for use in pineapples to control **Queensland and Mediterranean fruit fly**. | H | R1 |
| Clothianidin (Samurai) | 4A | | | P | | Not registered for use in pineapple. Registered in pome fruits, stone fruits, citrus and grapes for the control of a variety of insect pests. Uses include control programs for Queensland fruit fly and Mediterranean fruit fly as 3 consecutive (7 day Re-treatment interval) foliar sprays to Pome fruits, persimmon, stonefruits and table grapes. May be a potential option for a label extension to pineapples. | M<br><br>VH - bees | - |
| Maldison (Fyfanon) | 1B | | | P | | Not registered for use in pineapples. Registered for bait applications to fruit trees and perimeter treatments around blueberries, rubus & ribes and strawberries for the control of fruit fly. Registered for cover spray applications to apple, pear, citrus, grapevines, persimmons, stone fruit, berries, capsicum, tomato and cucumber for control of fruit fly. May be a potential option for a label extension to pineapples. | H | - |

| Pest / Active Ingredient (Trade Name) | Chemical group | Activity | WHP, days | Availability | States | Comments | Impact on beneficials | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| **Rats and mice** – house mouse (*Mus musculus*); black rat (*Rattus rattus*); brown/Norway rat (*Rattus norvegicus*)<br>**Priority:** Low | | | | | | | | |
| Rats can cause direct feeding damage to plant parts and fruits. Feedback indicated a lack of options for controlling these pests. | | | | | | | | |
| Coumatetralyl (Racumin) | - | | NR | A | ALL | Registered for use in pineapples to control **rats**. Bait stations should be placed at 9m intervals 1m inside the crop perimeters. Use and replenish baits from when fruit begins to form until after harvest. | | - |
| Cholecalciferol (Selontra) | - | | | P | | Not registered for use in pineapples. Registered for use along perimeter fence lines and in and around industrial, commercial, agricultural and domestic buildings for the control of rats and mice. Controls rats and mice resistant to anticoagulants. | | - |

## 4.3 Weeds in pineapple

### 4.3.1 Weed priorities

| Common Name | Scientific Name |
|---|---|
| **High** | |
| Blue billygoat weed (Bluetop) | *Ageratum houstonianum* |
| Billy goat weed (Bluetop) | *Ageratum conyzoides* |
| Praxelis | *Praxelis clematidea* |
| Pigweed | *Portulaca oleraces* |
| Goat weed (Licorice weed/sweet broom) | *Scoparia dulcis* |
| Carrot weed (Common Cotula) | *Cotula australis* |
| Pretty boy (dwarf poinsettia/painted spurge) | *Euphorbia cyatophora* |
| Nut grass (Sedge) | *Cyperus rotundus* |
| Thickhead | *Crassocephalum crepidioides* |
| **Moderate** | |
| Giant Sedge (scientific name not specified) | *Cyperus exaltatus?* |
| Giant paspalum (Vasey grass)/paspalum | *Paspalum urvillei / Paspalum dilatatum* |
| Giant rat's tail grass | *Sporobolus pyramidalis* |
| Tall boy (possibly a regionally specific name) | Uncertain |
| Green panic / Guinea grass | *Megathyrsus maximus var. maximus* |

Weeds were the number one priority pest control gap identified in this current SARP update. Feedback concentrated on diuron use restrictions and the lack of a suitable replacement. A variety of additional weed priorities were identified (and added to the table above), however bluetop in particular followed by praxelis were the most often reported. For the additional weeds raised by respondents, it is difficult to assess how important these pests are across the broader industry.

Pineapple has a 3-4 year growing period for 2 crop cycles, the plant crop and the ratoon. The very long cropping cycle increases the difficulty in dealing with weeds as a significant part of the weed control program is in-crop, thus limiting the range of options/techniques and where crop safety is a concern.

**Resistance management**
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 | | 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) – days from last treatment** | | **Resistance risk** | |
| Harvest | H | ** | Moderate resistance risk |
| Not Required when used as directed | NR | *** | High resistance risk |

| Active ingredient (Trade Name) | Chemical Group | Situation / Crop | Comment / Use / Weed | WHP (days) | Availability | States | Regulatory risk |
|---|---|---|---|---|---|---|---|
| Ametryn (various) | C** | Pineapple / Broad spectrum herbicide – post-emergent weeds | Crowsfoot grass, **pretty boy, sedges**, summer grass, and **thick head**. Following restrictions on diuron the original SARP noted a significant increase in reliance on ametryn with 6 applications made per year for post-emergent weeds. Provides some residual control. Misses seedling blue top, poor control of grasses. Commonly used option (original SARP data). [Do not apply rates of more than 4L/ha at less than 4 month intervals; Max 20L/ha per plant crop] | H:98 | A | QLD, NSW only | R3 |
| Bromacil (Uragan) | C** | Pineapple / Post-plant, pre-emergent knockdown | Barnyard grass, **billygoat weed / Bluetop**, cobbler's pegs, crowsfoot grass, **Guinea grass**, red natal grass, sourgrass, stinking roger, summer grass and **thickhead**. Commonly used option; by every grower immediately post plant (original SARP data). [Blanket spray immediately after planting or before plants start to grow plus an inter-row spray if necessary prior to flower differentiation] | NR | A | Qld, NT only | R3 |
| Bromacil + diuron (Krovar) | C** | Pineapple / Knockdown herbicide- some residual action | Asthma plant, barnyard grass, **billygoat weed**, cobbler's pegs, crowsfoot grass, fat-hen, **Guinea grass**, **pigweed**, *Physalis* spp., red natal grass, *Sonchus* spp. sourgrass, stinking roger, summer grass, and **thickhead**. [Max 13 kg/ha year] | NR | A | Qld only | R3 |

| Active ingredient (Trade Name) | Chemical Group | Situation / Crop | Comment / Use / Weed | WHP (days) | Availability | States | Regulatory risk |
|---|---|---|---|---|---|---|---|
| Diuron<br>PER81856<br>Version 3 | C** | Pineapple / Before fruit differentiation or flower bud formation / After flower bud formation in inter-rows only | Broadleaf and grass weeds as per Diuron label. Annual broadleaf weeds and some annual grasses. Specified weeds include **pigweed**, **Guinea grass**. [Max 1.8 kg/ha per 12 month period] | NR | A | Qld and NT only | R3 |
| Fluazifop-P (Fusilade Forte) | A*** | Pineapple / Post-emergent grass selective herbicide | Barnyard Grass, Crowsfoot Grass, Liverseed grass, Rhodes grass, Stinkgrass, Summer grass (crabgrass), **giant paspalum, green panic**. Plants of: carpet grass, couch grass, **giant paspalum**, Johnson grass, kikuyu grass, **paspalum**, and water couch re-established from seed or fragmented stems. Commonly used option (original SARP data). [Max no of appl'ns not specified] | H:14 | A | Qld, NT only | - |
| Fluometuron (Fluron) | C** | Pineapples / After planting or harvesting (ratoon crop) | Broadleaf and grass weeds, including **pigweed.** [Do not apply more than 3 overall sprays prior to bud formation, or more than 21 L/ha, per plant crop; additional inter-row appl'ns may be made to plant crop – refer to label] | H:49 | A | Qld, NSW only | - |
| Glufosinate (Basta) | N** | Pineapple / General knockdown using a shielded sprayer | Annual and perennial weeds, including ***Amaranthus* spp., Billy goat weed, Pigweed, Thickhead, *Paspalum* spp**. Used by some canning fruit growers in crop with shielded sprayers. Expensive and never caught on - not as effective as glyphosate (original SARP data). [Max no of appl'ns not specified] | NR | A | Qld, NSW, ACT, Vic, SA, WA, and NT only | R3 |
| Glyphosate (various) | M** | General seed bed preparation | General weed control as a pre-crop spray. Annual and perennial weeds including **Amaranthus spp., pigweed, Guinea grass, nutgrass, paspalum**. Very commonly used pre-planting. | NR | A | ALL | - |

| Active ingredient (Trade Name) | Chemical Group | Situation / Crop | Comment / Use / Weed | WHP (days) | Availability | States | Regulatory risk |
|---|---|---|---|---|---|---|---|
| Haloxyfop (Verdict) | A*** | Pineapple / Post-emergent grass selective herbicide (directed spray avoiding contact with fruit and foliage) | Perennial grasses: couch, Rhodes grass, slender rats tail grass, buffel grass, **green panic**, Johnson grass, kikuyu, ***Paspalum* spp.**, *Setaria* spp. Annual grasses: Annual ryegrass, barley grass, barnyard grass, brome grass, crowsfoot grass, lesser canary grass, liverseed grass, Mossman river grass, Paradoxa grass, summer grass, volunteer cereals, and wild oats. Used as a spot spray after canopy closure. Commonly used option (original SARP data). [Max no of appl'ns not specified] | NR | A | ALL | - |
| Paraquat + diquat (various) | L** | General seed bed preparation | General weeds as a pre-crop spray. Living mulch alternative. Sometimes used as a knockdown for old crop. [Max no of appl'ns not specified] | NR | A | ALL | R2 |
| Quizalofop-P (Targa) | A*** | Pineapple / Post-emergent grass selective herbicide | Awnless Barnyard Grass, couch grass, Dinebra, Crowsfoot grass, foxtail millet, Columbus grass, Johnson grass, liverseed grass, Rhodes grass, stink grass, Queensland blue grass, summer grass; and handgun spraying of Awnless barnyard grass, crowsfoot grass, **Paspalum**, Johnson grass, and Kikuyu. [Max no of appl'ns not specified] | H:7 | A | ALL | R3 |
| Metribuzin + Isoxaflutole | C** + H** | Pineapples | A new label extension in pineapples as part of Hort Innovation project ST15029 with Bayer – expected completion 1 July 2020. | | P | | - |

## 4.4 Plant growth regulation in pineapple

### 4.4.1 Plant growth regulation priorities

| Problem | Comment |
|---|---|
| **High priority** | |
| Plant Growth Regulators | Initiation of flowering and fruit ripening |
| | Increase the multiplication rate of planting material |
| | De-greening (fruit ripening) |

The critical importance of plant growth regulators to the pineapple industry for the initiation of flowering, fruit ripening and to increase the multiplication rate of planting material was re-enforced.

No specific threats to these use patterns were identified in the current update.

## 4.4.2 Available and potential plant growth regulation products

**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 |

| Active ingredient (Trade Name) | Chemical Group | Activity | Crop / Situation | Comment / Use | WHP, days | Availability | States | Regulatory risk |
|---|---|---|---|---|---|---|---|---|
| Ethephon (various) | - | Plant Growth Regulator | Pineapple | Initiation of flowering. Used to induce fruit in plant crops and ratoons. 1-2 applications. Fruit ripening (processing market). Commonly used: Almost every grower gave this use a high importance. | 7 | A | Qld and WA only | - |
| Ethephon PER14953 | - | Plant Growth Regulator | Pineapple (fresh market) | Fruit Ripening (de-greening). Use developed as part of project PI12005. For almost every grower this use is of moderate to high importance. | 2 | A | Qld and NT only | - |
| Chlorfurenol-methyl (Maintain) | - | Plant Growth Regulator | Pineapple planting material | To increase multiplication rate of pineapple planting material. Usually applied approx. one week after ethephon. For almost every grower this use is of moderate to high importance. | NR NG | A | Qld only | - |

# 5. References

## 5.1 Information:

| | |
|---|---|
| AgVet Collaborative Forum (Agrifutures Australia) | 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.comlaw.gov.au/Series/F2012L02501 |
| APVMA Permit search | https://productsearch.apvma.gov.au/permits |
| APVMA Product search | https://productsearch.apvma.gov.au/products |
| Codex MRL database | www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/ |
| Cotton Pest Management Guide 2018-19 | https://www.cottoninfo.com.au/publications/cotton-pest-management-guide |
| CropLife Australia (resistance management) | https://www.croplife.org.au/resources/programs/resistance-management/ |
| Growcom - Infopest Database | www.infopest.com.au |
| Hort Innovation | www.horticulture.com.au |
| Prevent Fruit Fly | http://preventfruitfly.com.au/fruit-fly-prevention-is-key-for-growers/ |

## 5.2 Abbreviations and Definitions:

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

## 5.3 Acknowledgements:

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

# 6. Appendices:

Appendix 1. Products available for disease control in pineapples
Appendix 2. Products available for control of insects, mites and other pests in pineapples
Appendix 3. Products available for weed control in pineapples
Appendix 4. Current permits for use in pineapples
Appendix 5. Pineapples Maximum Residue Limits (MRLs)
Appendix 6. Pineapple regulatory risk assessment

## Appendix 1. Products available for disease control in pineapple

| Active Ingredient (Trade Name) | Chem. group | Situation | Diseases / Comments | States | WHP Days | Regulatory risk |
|---|---|---|---|---|---|---|
| 1,3-dichloropropene + Chloropicrin (Tri-Form) | - | Field crops | Plant parasitic nematodes, symphylans, wireworms, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. | ALL (Restricted use TAS, VIC, SA) | NR | - |
| Chloropicrin (various) | 8B | General pre-plant soil fumigation | Nematodes (club root), insects, soil-borne fungus diseases, bacteria and weed seeds | ALL | NR | - |
| Dazomet (Cerlong) | - | Broadacre seed beds | Soil fungi (including *Phytophthora* spp.), nematodes (cyst and non-cyst forming), soil insects and germinating seeds of weeds. | ALL | NR | - |
| Didecyldimethyl-ammonium chloride (Sporekill disinfectant) | - | Post-harvest dip for assorted tropical and sub-tropical fruit | Post-harvest decay and diseases caused by microorganisms in water for washing or dip treatment processes | ALL | NR | - |
| Fludioxonil (e.g. Scholar Fungicide) PER84019 | 12 | Pineapple | Postharvest moulds (Penicillium spp.). Hort Innovation project MT17012 supported residue trials. | NSW, Qld & NT only | NR | - |
| Fosetyl (Nobility) | 33 | Soil drench and foliar spray | Phytophthora heart and root rot | Qld, NSW, WA only | 7 | - |
| Iodine (AIS Iodine Granules) | - | Post-harvest treatment – sanitiser | Post-harvest rots and moulds | ALL | NR | - |
| Mancozeb + Sulphur (various) | M3 | Seedlings (general) | Damping off | ALL | 7 | R2 |
| Metalaxyl (Zeemil) | 4 | Soil drench or foliar spray | Phytophthora heart and root rot | ALL | 28 | - |
| Metalaxyl-M (Ridomil) | 4 | Soil drench or foliar spray | Phytophthora heart and root rot | ALL | 28 | - |
| Metham sodium (Metham) | - | General pre-plant soil fumigation | Nematodes, germinating weed seeds (including fat hen), symphylids (not TAS) and fungus diseases (including *Phytophthora*) field application in beds or rows. Field application to total area NSW, QLD, SA, VIC, WA only. | Variable | NR | - |
| Phosphorous acid (Agri-Fos) | 33 | Pre-harvest (of planting material) foliar spray | Phytophthora heart and root rot | Qld, WA only | NR | - |

| Active Ingredient (Trade Name) | Chem. group | Situation | Diseases / Comments | States | WHP Days | Regulatory risk |
|---|---|---|---|---|---|---|
| Phosphorous acid PER83873 | 33 | Pineapple planting material (pre-plant dip) | Phytophthora heart and root rot | NSW, Qld, WA & NT only | NR | - |
| Potassium-monomethyl dithiocarbamate | - | General pre-plant soil fumigation | Metham potassium formulated variant: Nematodes, germinating weed seeds (including fat hen), symphylids (not TAS) and fungus diseases (including *Phytophthora*) field application in beds or rows. Field application to total area NSW, QLD, SA, VIC, WA only. | Variable | NR | - |
| Prochloraz (Sportak) | 3 | Post-harvest dip | Water blister | Qld, NSW, WA only | NR | - |
| Propiconazole (various) | 3 | Pineapple planting material (pre-plant dip) | Base rot (*Thielaviopsis paradoxa*) | Qld, NT, WA only | NR | - |

## Appendix 2. Products available for control of insects, mites and other pests in pineapple

| Active Ingredient (Trade Name) | Chem. group | Situation/Crop | Pests / Comments | States | WHP | Regulatory risk |
|---|---|---|---|---|---|---|
| 1,3-dichloropropene (Tri-Form) | - | Field crops | Plant parasitic nematodes. | ALL (Restricted use TAS, VIC, SA) | NR | - |
| 1,3-dichloropropene + Chloropicrin (Tri-Form) | - | Field crops | Soil borne diseases, plant parasitic nematodes, symphylans, wireworms and suppression of weeds | ALL (Restricted use TAS, VIC, SA) | NR | - |
| Abamectin PER81805 | 6 | Pineapple | Pineapple flat mite | NT & Qld only | H:112 | - |
| *Bacillus thuringiensis* subsp. *kurstaki* (Dipel) | 11A | Fruits | Armyworm, cotton bollworm, native budworm, cabbage moth, cabbage white butterfly, green looper, lightbrown apple moth, pear looper, soybean looper, vine moth, and tobacco looper. | ALL | NR | - |
| Bifenthrin (Astral) | 3A | Pineapple | Symphylids | Qld only | 90 | R3 |
| Chloropicrin (various) | 8B | General pre-plant soil fumigation | Nematodes (club root), insects, soil-borne fungus diseases, bacteria and weed seeds | ALL | NR | - |
| Chlorpyrifos (various) | 1B | Pineapple | Pineapple mealybug, ants and White grubs | Qld, WA only | NR | R2 |
| Coumatetralyl (Racumin) | - | Pineapple | Rats | ALL | NR | - |
| Dazomet (Cerlong) | - | Seed beds | Soil fungi, nematodes, soil insects and weeds | ALL | NR | - |
| Diazinon (Accensi) | 1B | Pineapple | Pineapple scale and mealybug | Qld, NSW, WA only | H:14 G:14 | R3 |
| Dimethoate PER10457 Version 6 | 1B | Pineapple | Pineapple red mite & flat mite | ALL | H:35 G:Nil | R3 |
| Dimethoate PER13859 | 1B | Orchard clean-up - fruit fly host crops following harvest | Fruit Fly | ALL | N/A | R3 |

| Active Ingredient (Trade Name) | Chem. group | Situation/Crop | Pests / Comments | States | WHP | Regulatory risk |
|---|---|---|---|---|---|---|
| Ethyl formate (Vapormate) | - | Post-harvest fumigant | Mites, mealybugs, and scale | ALL | NR | - |
| Iron EDTA Complex (Eradicate Slug and Snail Bait) | - | Plants generally | Slugs and snails | ALL | NR | - |
| Metaldehyde (various) | - | Plants generally | Slugs and snails | ALL | 7 | |
| Metham sodium (Metham) | - | Soil fumigation | Nematodes, germinating weed seeds (including fat hen), symphylids (not TAS) and fungus diseases (including *Phytophthora*) field application in beds or rows. Field application to total area NSW, QLD, SA, VIC, WA only. | Variable | NR | - |
| Potassium-monomethyl dithiocarbamate | - | Soil fumigation | Metham potassium formulated variant:<br>Nematodes, germinating weed seeds (including fat hen), symphylids (not TAS) and fungus diseases (including *Phytophthora*) field application in beds or rows. Field application to total area NSW, QLD, SA, VIC, WA only. | Variable | NR | - |
| Potassium salts of fatty acids (Natrasoap) | - | Outdoor crops | Aphids, thrips, mealybug, two-spotted mites, spider mite, and white fly | ALL | Nil | - |
| Pyriproxyfen (Distance) | 7C | Tropical fruit cropping areas | Invasive and nuisance ants | ALL | NR | - |
| Spirotetramat (Movento) PER81900 | 23 | Pineapple | Pineapple Mealybug suppression | Qld & NT only | H:14<br>G:Nil | - |
| Sulfoxaflor (Transform) PER81901 | 4C | Pineapple | Pineapple Mealybug | Qld & NT only | H:14<br>G:NR | - |
| Trichlorfon PER12450 Version 6 | 1B | Pineapple | Queensland and Mediterranean fruit fly | ACT, NSW, NT, Qld, SA, and WA | H:7 | R1 |

## Appendix 3. Products available for weed control in pineapples

| Active ingredient (Trade Name) | Chem. Group | Situation | Comment / Use / Weed | WHP (days) | States | Regulatory risk |
|---|---|---|---|---|---|---|
| Ametryn (various) | C | Pineapple / Broad spectrum herbicide – post-emergent weeds | Crowsfoot grass, pretty boy, sedges, summer grass, and thick head | H:98 | QLD, NSW only | R3 |
| Bromacil (Uragan) | C | Pineapple / Post-plant, pre-emergent knockdown / also as inter-row spray prior to flower differentiation. | Barnyard grass, billygoat weed, cobbler's pegs, crowsfoot grass, Guinea grass, red natal grass, sourgrass, stinking roger, summer grass, and thickhead | NR | Qld, NT only | R3 |
| Bromacil + diuron (Krovar) | C | Pineapple / Knockdown herbicide- some residual action | Asthma plant, barnyard grass, billygoat weed, cobbler's pegs, crowsfoot grass, fat-hen, Guinea grass, pigweed, *Physalis* spp., red natal grass, *Sonchus* spp. sourgrass, stinking roger, summer grass, and thickhead | NR | Qld only | R3 |
| Diuron PER81856 Version 3 | C | Pineapple / Before fruit differentiation or flower bud formation / After flower bud formation in inter rows only | Broadleaf and grass weeds as per Diuron label including pigweed | NR | Qld and NT only | R3 |
| Fluazifop-P (Fusilade Forte) | A | Pineapple / Post-emergent grass selective herbicide | Barnyard Grass, Crowsfoot Grass, Liverseed grass, Rhodes grass, Stinkgrass, Summer grass (crabgrass), giant paspalum, green panic. Plants of: carpet grass, couch grass, giant paspalum, Johnson grass, kikuyu grass, paspalum, and water couch re-established from seed or fragmented stems. | H:14 | Qld, NT only | - |
| Fluometuron (Fluron) | C | Pineapples / After planting or harvesting (ratoon crop) | Broadleaf and grass weeds | H:49 | Qld, NSW only | - |

| Active ingredient (Trade Name) | Chem. Group | Situation | Comment / Use / Weed | WHP (days) | States | Regulatory risk |
|---|---|---|---|---|---|---|
| Glufosinate (Basta) | N | Pineapple / General knockdown using a shielded sprayer | Annual and perennial weeds | NR | Qld, NSW, ACT, Vic, SA, WA, and NT only | R3 |
| Glyphosate (various) | M | General seed bed preparation | General weeds as a pre-crop spray | NR | ALL | - |
| Haloxyfop (Verdict) | A | Pineapple / Post-emergent grass selective herbicide (directed spray avoid contact with fruit and foliage) | Perennial grasses: couch, Rhodes grass, slender rats tail grass, buffel grass, green panic, Johnson grass, kikuyu, *Paspalum* spp., *Setaria* spp. Annual grasses: Annual ryegrass, barley grass, barnyard grass, brome grass, crowsfoot grass, lesser canary grass, liverseed grass, Mossman river grass, Paradoxa grass, summer grass, volunteer cereals, and wild oats | NR | ALL | - |
| Paraquat + diquat (various) | L | General seed bed preparation | General weeds as a pre-crop spray | NR | ALL | R2 |
| Quizalofop-P (Targa) | A | Pineapple / Post-emergent grass selective herbicide | Awnless Barnyard Grass, couch grass, Crowsfoot grass, foxtail millet, Columbus grass, liverseed grass, Rhodes grass, stink grass, Queensland blue grass, summer grass, Paspalum, Johnson grass, Kikuyu, | H:7 | ALL | R3 |

## Appendix 4. Current permits for use in pineapple

| Permit No. | Description | Issued Date | Expiry Date | States | Permit Holder |
|---|---|---|---|---|---|
| PER81805 | Abamectin / Pineapple / Pineapple flat mite | 2-Aug-16 | 31-Jul-20 | NT & Qld only | Growcom |
| PER87066 Version 1 | Dimethoate / Pineapple / Red mite & Flat mite | 1-Mar-19 | 31-Mar-24 | ALL | Hort Innovation |
| PER13859 Version 2 | Dimethoate / Orchard cleanup - fruit fly host crops following harvest / Fruit Fly | 9-Feb-15 | 31-Jul-24 | ALL | Hort Innovation |
| PER81856 Version 3 | Diuron / Pineapples / Weeds as per Diuron label | 16-Jun-16 | 30-Nov-19 | Qld & NT only | Growcom |
| PER14953 | Ethephon / Pineapple (fresh market) / Fruit Ripening | 18-Dec-14 | 25-Dec-24 | Qld & NT only | Growcom |
| PER84019 | Fludioxonil (e.g. Scholar Fungicide) / Pineapple (fresh only) / Postharvest moulds (Penicillium spp.) | 01-Sep-17 | 30-Sep-22 | NSW, Qld & NT only | Growcom |
| PER83873 | Phosphorous acid / Pineapple planting material (pre-plant dip) / Phytophthora heart and root rot | 22-Feb-18 | 28-Feb-21 | NSW, Qld, WA & NT only | Growcom |
| PER81901 Version 2 | Sulfoxaflor (Transform) / Pineapple / Pineapple Mealybug | 24-Aug-16 | 28-Feb-23 | Qld & NT only | Hort Innovation |
| PER81900 | Spirotetramat (Movento) / Pineapple / Pineapple Mealybug suppression | 17-Dec-16 | 30-Sep-19 | Qld & NT only | Growcom |
| PER12450 Version 6 | Trichlorfon / Specified Fruit crops / Fruit fly | 06-Oct-11 | 31-Jan-21 | ACT, NSW, NT, Qld, SA, and WA | Growcom |

## Appendix 5. Pineapple Maximum Residue Limits (MRLs)

| Chemical | Codex | Description | APVMA MRL mg/kg | Codex MRL mg/kg |
|---|---|---|---|---|
| Abamectin | FI 0353 | Pineapple | T*0.002 | - |
| Aldrin and Dieldrin | | Fruits | E0.05 | - |
| Ametryn | FI 0353 | Pineapple | *0.05 | - |
| Amitrole | FI 0353 | Pineapple | *0.01 | - |
| Azinphos-Methyl | A02 0002 | Fruits | - | 1 |
| Benfluralin | FI 0353 | Pineapple | T*0.01 | - |
| Bifenthrin | FI 0353 | Pineapple | *0.01 | - |
| Bromide Ion | A02 0002 | Fruits | - | 20 |
| Bromacil | FI 0353 | Pineapple | *0.04 | - |
| Carbendazim | FI 0353 | Pineapple | - | 5 |
| Carfentrazone-ethyl | FI 0030 | Tropical – inedible peel | *0.05 | - |
| Chlordane | FI 0353 | Pineapple | E0.02 | - |
| Clothianidin | FI 0353 | Pineapple | - | *0.01 |
| Chlorpyrifos | FI 0353 | Pineapple | T0.5 | - |
| DDT | | Fruits | E1 | - |
| | | Fruits | 0.5 | - |
| Diazinon | FI 0353 | Pineapple | - | 0.1 |
| Didecyldimethyl ammonium chloride | FI 0030 | Tropical – inedible peel | 20 | - |
| Dicofol | | Fruits | 5 | - |
| Dimethoate | FI 0030 | Tropical – inedible peel | 5 | - |
| Dimethomorph | FI 0353 | Pineapple | - | *0.01 |
| Diquat | | Fruits | *0.05 | - |
| Disulfoton | FI 0353 | Pineapple | - | 0.1 |
| Dithianon | | Fruits | 2 | - |
| Diuron | FI 0353 | Pineapple | 0.5 | - |
| Ethephon | FI 0353 | Pineapple | 2 | 1.5 |
| Fenbutatin oxide | FI 0030 | Tropical – inedible peel | 5 | - |
| Fipronil | FI 0353 | Pineapple | T*0.01 | - |
| | FI 0030 | Tropical – inedible peel | T*0.01 | - |
| Fluazifop-p-butyl | FI 0030 | Tropical – inedible peel | 0.05 | - |
| Fludioxonil | FI 0353 | Pineapple | T20 | - |
| Fluometuron | FI 0353 | Pineapple | *0.1 | - |
| Fosetyl | FI 0353 | Pineapple | 5 | - |
| Glufosinate & Glufosinate ammonium | FI 0030 | Tropical – inedible peel | 0.2 | 0.1 |
| Haloxyfop | FI 0030 | Tropical – inedible peel | *0.05 | - |
| Heptachlor | FI 0353 | Pineapple | E0.01 | E0.01 |
| Hexazinone | FI 0353 | Pineapple | 1 | - |
| Inorganic bromide | | Fruits | 20 | - |
| Isoxaben | FI 0030 | Tropical – inedible peel | *0.01 | - |
| Lindane | FI 0353 | Pineapple | 0.5 | - |
| Maldison | | Fruits | 2 | - |
| Metalaxyl | FI 0353 | Pineapple | 0.1 | - |
| Metaldehyde | | Fruits | 1 | - |
| Methidathion | FI 0353 | Pineapple | - | 0.05 |
| Methiocarb | | Fruits | T0.1 | - |
| Methyl bromide | | Fruits | T*0.05 | - |
| Naphthalene acetic acid | FI 0353 | Pineapple | 1 | - |

| Chemical | Codex | Description | APVMA MRL mg/kg | Codex MRL mg/kg |
|---|---|---|---|---|
| Omethoate | | Fruits | 2 | - |
| Oryzalin | | Fruits | 0.1 | - |
| Oxyfluorfen | FI 0030 | Tropical – inedible peel | *0.01 | - |
| Paclobutrazol | FI 0030 | Tropical – inedible peel | *0.01 | - |
| | | Fruits | *0.05 | - |
| Paraquat | FI 0030 | Tropical – inedible peel | - | *0.01 |
| Pendimethalin | FI 0030 | Tropical – inedible peel | *0.05 | - |
| Phosphine | FI 0030 | Tropical – inedible peel | T*0.01 | - |
| Phosphorous acid | FI 0030 | Tropical – inedible peel | T100 | - |
| Piperonyl butoxide | | Fruits | 8 | - |
| Pirimicarb | | Fruits | 0.5 | - |
| | FI 0353 | Pineapple | 2 | - |
| Prochloraz | FI 0030 | Tropical – inedible peel | - | Po7 |
| Propiconazole | FI 0353 | Pineapple | 0.05 | *0.02 |
| Pyrethrins | | Fruits | 1 | - |
| Quizalofop-ethyl | FI 0353 | Pineapple | *0.05 | - |
| Quizalofop-P-tefuryl | FI 0353 | Pineapple | *0.05 | - |
| Simazine | | Fruits | *0.1 | - |
| Spinetoram | FI 0030 | Tropical – inedible peel | 0.3 | - |
| Spinosad | FI 0030 | Tropical – inedible peel | 0.3 | - |
| Spirotetramat | FI 0353 | Pineapple | T0.1 | - |
| Sulfloxaflor | FI 0353 | Pineapple | T0.1 | - |
| Thiamethoxam | FI 0353 | Pineapple | - | *0.01 |
| Triadimefon | FI 0353 | Pineapple: (based on triadimenol use only | - | Po5 |
| Triadimenol | FI 0353 | Pineapple | - | Po5 |
| Trichlorfon | FI 0030 | Tropical – inedible peel | T3 | - |
| Trifluralin | | Fruits | *0.05 | - |

NOTE: MRLs are constantly under review and subject to change. Check for current MRLs and do not rely on the values stated above.

NOTE: For the groups "Assorted tropical and sub-tropical fruits – inedible peel" and "Fruits" listed above, (non-pineapple) 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 Instrument No. 4 (MRL Standard) 2012. Compilation 72. Prepared 31 January 2019. CODEX MRLs: In addition to the CODEX database, meeting reports were used to update recent changes (to February 2019).

## Appendix 6. Pineapple regulatory risk assessment

(This document was prepared as part of the Hort Innovation funded project MT17019 – Regulatory Support & Co-ordination.)

### Pineapple Agrichemical regulatory risk assessment

**February 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 require the generation of new data. A consequence of which can be that many of these chemicals 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 farm chemicals 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 prohibiting the use in the exporting country to ensure compliance, as breaches of MRLs would adversely affect market access.

The effects of the above are greater pressure placed on the availability and use of individual chemicals 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 pineapples as well as current initiatives aimed at addressing identified pest management deficiencies.

## Pineapple regulatory risk assessment

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

| Problem | Active Constituents | Chemical group | Comments | Current activities |
|---|---|---|---|---|
| **INSECTS & MITE PESTS** | | | | |
| Ants | chlorpyrifos | **1B** | Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally | |
| Mediterranean fruit fly/ Queensland fruit fly | trichlorfon | **1B** | APVMA – nominated for review<br>Codex – No MRLs<br>Europe – deregistered<br>US – No MRLs<br>Registrant support uncertain | |
| Nematodes | 1,3-dichloropropene | **-** | Europe – Recent risk assessment completed, A number of critical areas of concern identified. | |
| Pineapple flat mite | Abamectin (PER81805) | **6** | | APVMA advice registration would likely be supported by submission of the full trial reports referenced in support of the permit application. |
| | Dimethoate (PER10457) | **1B** | To be reviewed by JMPR/Codex 2019/20.<br>Europe – Proposing to drop all MRLs to <0.01 mg/kg | Permit renewal application submitted.<br>Residue trial data provided to a registrant to seek label extension. |
| | Ethyl formate (Po) | | Never notified and authorised in the EU | |

| Problem | Active Constituents | Chemical group | Comments | Current activities |
|---|---|---|---|---|
| Pineapple Mealybug/ Mealybug | Chlorpyrifos | **1B** | Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally | |
| | diazinon | **1B** | EU – deregistered | |
| | Spirotetramat (PER81900) | **23** | | Data generation project (ST16006) initiated to support registration |
| | Sulfoxaflor (PER81901) | **4C** | USA – Pollinator concerns | Permit renewal application submitted. |
| Pineapple scale | chlorpyrifos | **1B** | Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally | |
| | diazinon | **1B** | EU – deregistered | |
| | Ethyl formate (Po) | | Never notified and authorised in the EU | |
| symphylids | bifenthrin | **3A** | EU – Possible fail of the Hazard thresholds | |
| White grubs | chlorpyrifos | **1B** | Currently under review by the APVMA & outcome uncertain. Ongoing issues internationally | Data generated under project ST17000 initiated to evaluate potential alternative insecticide. |
| **DISEASES** | | | | |
| Base rot | propiconazole | **3** | EU – deregistered<br>APVMA – nominated for review | |
| Blue & green moulds | Fludioxonil (PER84019) | **12** | | Data generated under project MT17012 to support permit application. |
| Phytophthora | fosetyl-Al | **33** | | |
| | metalaxyl/metalaxyl-M | **4** | | |
| | phosphorous acid | **33** | | Data generated under project PI12006 to support permit registration. |

| Problem | Active Constituents | Chemical group | Comments | Current activities |
|---|---|---|---|---|
| Water blister | prochloraz | **3** | | |
| Bactericide | iodine | **M** | | |
| **WEEDS** | | | | |
| Broadleaf weeds and grasses | ametryn | **C** | EU – deregistered | |
| | bromacil | **C** | EU – deregistered | |
| | diuron (PER81856) | **C** | EU – Re-authorisation review currently underway | Permit renewal application submitted.<br>Data generation project initiated (ST15029) to evaluate **isoxaflutole** and **metribuzin** as potential diuron replacements. |
| | fluazifop-P | **A** | | |
| | fluometuron | **C** | | |
| | glufosinate | **N** | Europe – deregistered | |
| | haloxyfop-P | **A** | | |
| | quizalofop-P | **A** | Canada – Under re-evaluation - proposed completion June 2019.<br>EU – Candidate for substitution | |
| **Plant growth regulators** | | | | |
| Plant growth regulators | Ethephon | | | |
| | Chlorflurenol-methyl | | | |