CROP PROTECTION IN THE TROPICS

Tropical and sub-tropical crops can be broadly defined as those that have their origin or are grown commercially in the tropics or sub-tropics. Strictly speaking, the tropics extend between the Tropics of Cancer and Capricorn, at 23° north and south of the equator. Agronomically speaking, these boundaries are too rigid.

The expansion of horticultural production in these regions has come as a result of a growing export market focus as well as the ability to get earlier market access within the domestic market.

Despite this, challenges remain with rainfall variability, cost of transport, labour availability and, above all, the effects of wind (nearly all major production areas have suffered loss as a consequence of cyclones) limiting the potential of various crops.

Hundreds of tropical and sub-tropical crop types exist. Coupled with this, many temperate crops are grown in tropical or sub-tropical areas.
This pocket guide does not aim to cover all of the crops that are grown in the tropical and sub-tropical areas of Australia, rather it provides information on some of the key fruit crops grown in these areas. Likewise, this guide only covers some of the key pests and diseases that are prevalent in these areas.

We trust that this pocket guide assists tropical and sub-tropical fruit growers in Australia to better manage pests and diseases within their crops.
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DISEASE MANAGEMENT
ANTHRACNOSE
(*Colletotrichum* spp.)

**Susceptible Crops**
Mangoes

**Source and Spread**
- The fungus survives on undecomposed crop residues.
- Anthracnose development is favoured by warm, humid weather.
- Spores are spread by splashing water.

**Symptoms**
- On leaves, small black spots expand and combine forming large, black and dry areas. These often crack and fall out.
- On flowers, small black, irregular spots expand and combine to cause shedding and death of flowers.
- On fruit, small black spots enlarge to become irregular, slightly sunken, dark brown to black areas on ripening fruit.
**BLACK SPOT**  
* (Diplocarpon rosae)  

**Susceptible Crops**  
Citrus and papaya  

**Source and Spread**  
- The fungus survives on the leaf litter in citrus orchards and on diseased leaves and fruit in papaya plantations.  
- Intermittent moisture cycles favour disease development.  
- Spores are spread by wind.  

**Symptoms**  
- **Citrus:** Symptoms are classified into four distinct types. Specked blotch, Freckle spot, Hard spot and Virulent spot. They all have varying characteristics.  
- **Papaya:** On older leaves spots develop that are 1-3 mm in diameter, circular and initially water soaked, later becoming brown in colour.  
- Masses of dark brown to black spores form on the underside of leaves. Severely affected leaves curl, turn brown and die.  
- Fruit spots are 2-6 mm in diameter and are brown to black in colour. The tissue behind these spots becomes corky.
Symptoms on peaches (3)

Susceptible Crops
Nectarines and peaches

Source and Spread
• The fungus survives on mummified fruit and diseased fruit stalks and twigs.
• During spring, large numbers of spores develop and spread to the emerging blossoms. Blossoms that remain wet for more than 10 hours become infected and symptoms develop.
• Spores are spread by wind, rain and insects.

Symptoms
• Affected blossoms turn brown and wilt, and the petals wrap around the centre of the flower. Gum residue may exude from the flower stalk.
• Twigs bearing infected blossoms may develop light brown spots up to 30 mm long and often exude gum.
• Leaves on infected twigs wilt, turn brown and fall, and the twigs begin to die back.
• On fruit, small, round, brown spots develop which rapidly enlarge in moist conditions to form a relatively firm brown rot. The rotted portions soften on the fruit forming a gooey mass in wet weather. Light brown, powdery clumps of spores develop on rotted areas and fruit eventually shrivel and mummify.
YELLOW SIGATOKA
(Leaf spot)

Susceptible Crops
Bananas

Source and Spread
• The yellow sigatoka fungus produces two types of spores (conidia and ascospores) which can only infect young banana leaves.
• Ascospores are released after rain and spread by wind and rain splash. They cause new infection sites and the spread of disease to neighbouring plantations.
• Conidia are produced daily on infected leaf spots and do not move far. They cause increased disease levels within the canopy.

Symptoms
• Early symptoms occur before flowering, when the third and fourth leaves from the centre exhibit light yellow or brown-green streaks that are 1-2 mm long and parallel to the veins. The fifth and sixth leaves then develop muddy brown or black oval spots up to 10 mm long.
• On older leaves, spots are light grey, with dark brown or black borders, often surrounded by a yellow halo.
• When disease is severe, bunches are small, fruit ripens early and unevenly, is poorly filled and prone to sunburn because of leaf loss.
**Bananas, Citrus, Custard apples, Mangoes, Passionfruit, Papaya and Stone fruit**

**PRODUCT PROFILE**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Active ingredient</td>
<td>Mancozeb</td>
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<tr>
<td>Formulation</td>
<td>Water dispersible granule</td>
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<tr>
<td>Fungicide group</td>
<td>Group M3</td>
</tr>
<tr>
<td>Target diseases</td>
<td>Many diseases in a wide range of fruit and vegetable crops grown in sub-tropical areas</td>
</tr>
<tr>
<td>Activity</td>
<td>Protectant</td>
</tr>
<tr>
<td>Packaging</td>
<td>20 kg bag</td>
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<tr>
<td>Application rate</td>
<td>See label as rates vary with pest and crop</td>
</tr>
</tbody>
</table>

**KEY FEATURES**

- Well established reputation of proven product performance as the world's largest selling protectant fungicide.
- Multi-site activity making it a very effective partner in a disease resistance management program.
- New improved formulation providing improved rainfastness and superior wetting, spreading and sticking on leaves.
- Very low levels of dust.

**APPLICATION & USE**

- Can be applied as a dilute or concentrate spray.
- Treatments should begin prior to disease infection and continue until threat of disease has passed.
- Reduce the spray interval when wet weather conditions favour disease development.
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<th></th>
<th>Bananas</th>
<th>Citrus</th>
<th>Custard apples</th>
<th>Mangoes</th>
<th>Nectarines</th>
<th>Papaya</th>
<th>Passionfruit</th>
<th>Peaches</th>
<th>Pears</th>
<th>Rockmelons</th>
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# CROP DISEASE READY REFERENCE GUIDE

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<td>Pseudocercospora fruit spot</td>
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<td>Septoria spot</td>
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**Indar™ Fungicide**

**Bananas and Nectarines**

**PRODUCT PROFILE**

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Fenbuconazole</th>
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<tr>
<td>Formulation</td>
<td>Suspension concentrate</td>
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<tr>
<td>Fungicide group</td>
<td>Group 3</td>
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<tr>
<td>Target diseases</td>
<td>Bananas - Leaf spot/Yellow sigatoka and Black sigatoka Nectarines - Brown rot</td>
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<tr>
<td>Activity</td>
<td>Protectant</td>
</tr>
<tr>
<td>Packaging</td>
<td>10 L containers</td>
</tr>
<tr>
<td>Application rate</td>
<td>Bananas - 420 mL/ha Nectarines - 15 mL/100 L water</td>
</tr>
</tbody>
</table>

**KEY FEATURES**

- Excellent protection of the fruit and leaf by remaining on the fruit and leaf surface longer.
- Strong residual activity.
- Excellent rainfastness.

**APPLICATION & USE**

- Can be applied as a dilute or concentrate spray.
- Nectarines - Apply 2 sprays 3 weeks apart and 1 week prior to harvest. In susceptible varieties or conditions that favour disease development, an additional spray may be required. DO NOT apply more than 2 consecutive sprays of Group 3.
- Bananas - Apply on a schedule of 14–21 day intervals using the shorter interval during periods of high disease pressure. Always apply 2 consecutive sprays of Indar Fungicide. DO NOT apply more than 5 Group 3 fungicides in a 12 month period.
PEST MANAGEMENT
FRUIT FLY (Queensland fruit fly and Mediterranean fruit fly)
(Bactrocera tryoni and Ceratitis capitata)

Susceptible Crops
Most fruit, nut and vine crops

Description and Lifecycle
• The adult Queensland fruit fly is wasp-like, red-brown with yellow marks, and about 8 mm long.
• Queensland fruit flies hold their wings outstretched in a horizontal position when walking, flicking them in a characteristic manner.
• The adult Mediterranean fruit fly is slightly smaller than a housefly, its back is mottled with shiny and dull black and yellowish-white areas, and the abdomen is yellowish to brown with two pale cross bands.

Damage
• Affected fruit are readily recognised since rot develops rapidly and the skin around the sting marks becomes discoloured.
Susceptible Crops
Citrus

Description and Lifecycle
- Caterpillars grow between 40 to 50 mm long and at this size they are green, yellow, pink, reddish brown or almost black, often with a broad yellowish white stripe along each side of the body and a dark edged whitish line down the middle of the back.
- Caterpillars also have conspicuous body hairs on tubercles.
- Adult moths have wingspans of between 30 and 45 mm, are generally buff to reddish brown, with darker markings, and are often seen flying in crops at dusk.
- The complete lifecycle is between 30 and 50 days.
- They are most troublesome between summer and spring.

Damage
- Larvae prefer to feed on flowers and developing fruit.
- Caterpillars may also feed on the outer leaves of young plants or burrow into the hearts of older plants.
LEAFROLLERS
(Avocado leafroller and Ivy leafroller)

Susceptible Crops
Avocados and certain other tropical and sub-tropical fruits

Description and Lifecycle
• Adult moths are mottled grey to light brown in colour and up to 25 mm long. At rest, wings are slightly folded downwards and appear bell-shaped.
• Avocado leafroller: Pale yellow eggs are laid in masses on the upper side of mature leaves. Larvae grow to 25 mm long, are green, with a white head capsule that has two black patches.
• Ivy leafroller: Green eggs are laid in masses on the upper side of mature leaves. Larvae grow to 25 mm long, are translucent green-yellow with a white head capsule that has four distinct black, wedge shaped marks.
• Eggs hatch after 6–8 days with larvae dropping on silken like threads to be dispersed by the wind or crawl to a suitable feeding site. They feed for up to 6 weeks before pupating.

Damage
• Caterpillars roll and web (join) leaves and fruit where they shelter, feed and develop.
• Whilst leaf damage may be severe, fruit damage is more important with large areas of fruit skin being eaten to a depth of 4 mm.
• Damaged fruit may be infected with anthracnose and drop, or mature with scar tissue showing on the skin.
Susceptible Crops
Avocados, tropical and sub-tropical fruits

Description and Lifecycle
• Many species exist but all move with a distinctive style, arching their bodies or ‘looping’ when they crawl.
• Adult moths are brown or grey in colour with silvery or coppery marks on their forewings.
• Caterpillars are slender and grow to between 20–60 mm in length and 3–10 mm wide. They vary in colour from green to grey, brown and black. They have no legs near the middle of the body.

Damage
• Young caterpillars eat through leaves leaving window-pane like holes while older caterpillars chew large, ragged holes in leaves.
• In fruit trees they generally strip the leaf to the mid-rib or leave scalloped margins.
LARGE MANGO TIP BORER
(Penicillaria jocosatrix)

Susceptible Crops
Mangoes

Description and Lifecycle
- The adult moths have russet-brown forewings with purple patches. The rear-wings are white with smoky brown margins.
- The adult moth lays her eggs singly onto the leaf surface of the new growth.
- Larvae are yellow-green but can vary greatly in colour with some being pink-purple with rows of small burgundy-red spots.
- A complete lifecycle is about 35 days.

Damage
- Larvae feed on new ‘flush’ growth before it changes from purple to green.
- First and second stage larvae feed on the under-surface of the leaves around the edges to produce a window like effect.
- As the larvae moult into their later instars, the entire leaf is eaten, producing a ragged edge appearance.
- Successive growth flushes can be removed completely and flowers are also eaten.
Susceptible Crops
Mangoes

Description and Lifecycle
• The scale appears as a cluster of small white scales in an infestation approximately 2 cm in diameter. They are found on the upper leaf surface, and may be found on the fruit.
• After hatching, crawlers move to feeding sites settling within 24 hours.
• Female crawlers settle randomly and once settled secrete a substance which will eventually become the protective scale cover. When mature, they are circular in appearance and have a dark spot to one side which is the old pupal case.
• Male crawlers settle in groups and secrete white filaments which curl over them as they mature. They secrete an almost rectangular protective scale cover with three distinct longitudinal ridges. Adult males have two wings and are capable of flight.
• A complete lifecycle is approximately 35-40 days in summer and 75-80 days in winter and it generally peaks at flowering.

Damage
• Infested areas on leaves turn pale green to yellow and heavy infestations can kill leaves and branches.
• Infestations on the fruit are characterised by the presence of scales and pink blemishes.
MEALYBUGS
(Citrophilous and Longtailed mealybug)

Susceptible Crops
Citrus and some tropical fruits

Description and Lifecycle
• Depending on species, adults are around 3 mm long, oval shaped with distinct body segmentation and are more or less covered with white flocculent or mealy wax.
• When squashed, the body fluids are seen to be pale yellow.
• Female mealybugs produce eggs that are hatched within the body.
• Nymphs are very active and produce considerable quantities of honeydew during the course of their development.
• The complete lifecycle takes about 6 weeks during the warmer summer months and there are several generations annually.

Damage
• Excretion of honeydew causes extensive contamination of fruits and foliage.
• Heavy infestations can cause leaves to turn yellow and wilt, shoots and branches to distort, reduced cropping and ultimately death of the tree.
RED-BANDED THRIPS
(Selenothrips rubrocinctus)

Susceptible Crops
Many tropical and sub-tropical fruits

Description and Lifecycle
• Adult thrips have dark bodies with a red band on the first three abdominal segments. They are about 3 mm in length and have two pairs of clear wings that have large fringing hairs around the whole margin.
• The first two abdominal segments in the nymphs are light orange and the anal segments are bright red.
• Eggs are inserted into the tissue on the lower leaf surface and covered with a drop of fluid that dries to form a black, disc-like cover. Nymphs emerge in about 12 days.
• A single generation is completed within two weeks.

Damage
• Both immature and adult thrips feed by sucking sap from cells.
• The preferred feeding site for thrips is the tissue next to the mid-rib on the under surface of leaves, but in severe infestations fruit is also attacked.
• The first sign of damage is silvering of leaves and fruit.
• In severe infestations, the silvering develops into a pale-yellow to brown discolouration, speckled with dark coloured dried droppings.
SUGARCANE BUD MOTH
(Opogona glycyphaga)

Susceptible Crops
Bananas

Description and Lifecycle
• Adult moths are small (10 mm long and 2 mm wide) and brightly coloured with bright yellow antennae. The forewings are bright yellow with purple-brown elongated blotches at the front and rear margins. Wingspan is approximately 15 mm. The hind wings are pale-yellow and feathery. During the day, adults rest with wings folded on banana leaves, leaf petioles and fruit. Because of their small size, they are seldom seen.
• Larvae are pinkish-yellow to dark grey and are seldom seen since they feed in secluded areas of the bunch covered by the fruit fingers. Larvae moult a number of times and when fully grown are approximately 16 mm long.
• The light-brown pupa is covered by a tough silken cocoon spun by the larva. It is completely hidden under black pellets of excreta. The silken cocoon is attached to the banana fruit usually between the fingers near feeding sites.

Damage
• Larvae commence feeding on the surface of fruit after the bracts have fallen and cause superficial scarring of fruit.
• Damage is less severe than that caused by scab moth and is usually concentrated on the outside tip of banana fingers where contact occurs between the lower hand and those hands immediately above.
Western Flower Thrip
(Frankliniella occidentalis)

Susceptible Crops
Stone fruit and some sub-tropical fruits

Description and Lifecycle
- Western flower thrips breed on a wide range of flowering plants including weeds and fruit trees.
- Immature thrips are pale yellow, thin, wingless and up to 1 mm in length.
- Adults are about 1.5-2 mm in length, thin, with a yellowish head and darker abdomen, and two feathery wings.
- The length of the lifecycle and life expectancy of the adults depend on temperature and food quality. At 30°C the lifecycle is approximately 12 days while at 20°C it is about 19 days.

Damage
- Feeding by thrips damages both flowers and fruit, with feeding during fruit formation resulting in scarred and deformed fruit.
YELLOW PEACH MOTH
(Conogethes punctiferalis)

Susceptible Crops
Citrus, stone fruit, and a range of tropical and sub-tropical fruits

Description and Lifecycle
• The orange-yellow moths have a wing span of 25 mm and a number of conspicuous black spots on the wings and body.
• The eggs are small and are laid on the developing fruit or near the growing point.
• The entire larval stage occurs whilst the pest lives in the plant tissue. After about 3 weeks in summer, larvae are mature, 25 mm long, greyish-green and tinged pink. They pupate on the outside of the fruit in shelters of webbed frass.
• The lifecycle from egg to adult takes 6 weeks in summer.

Damage
• Larvae burrow into the fruit, particularly where fruit touch.
• Larvae may also burrow into the growing point of unthrifty or diseased trees. The entrance hole is covered with frass and webbing.
Applaud®
INSECTICIDE
Citrus, Custard apples, Mangoes and Passionfruit

PRODUCT PROFILE

Active ingredient  Buprofezin
Formulation       Suspension concentrate
Insecticide group Group 16
Target pests      Predominantly scale and mealybugs
Activity          Contact and ingestion
Packaging         1 L and 10 L containers
Application rate  30–60 mL/100 L water

KEY FEATURES

• Outstanding efficacy on nymphs and crawlers.
• Ideal for use in IPM programs with excellent safety, especially to parasitoid wasps.
• Highly favourable environmental and OH&S profile.

APPLICATION & USE

• Can be applied as a dilute or concentrate spray.
• Sprays should ONLY be targeted at juvenile forms of the pest.
• Apply a repeat application if required.
• DO NOT apply more than twice per year on any crop.
Stone fruit

PRODUCT PROFILE

Active ingredient: Spinetoram
Formulation: Water dispersible granule
Insecticide group: Group 5
Target pests: Lightbrown apple moth and Oriental fruit moth
Activity: Contact and ingestion
Packaging: 800 g containers
Application rate: 10-15 g/100 L water

KEY FEATURES

• A unique mode of action (effective insect resistance management program partner).
• Ideal for use in IPM programs (safe to most key beneficial insects).
• A very short re-entry period profile.
• Excellent fruit finish.
• A short 3 day withholding period.
• Highly favourable environmental and OH&S profile.

APPLICATION & USE

• Can be applied as a dilute or concentrate spray.
• Best results are achieved when sprays are targeted against mature eggs and newly hatched larvae.
• Apply repeat applications at 14 day intervals as egg hatch continues or new infestations occur.
• Apply higher rates under high pest pressure or when spray intervals exceed 14 days.
• DO NOT apply more than 4 applications per season.
**Lorsban™ 500EC INSECTICIDE**

Avocados, Bananas, Citrus, Pineapples, Stone fruit and Strawberries

### PRODUCT PROFILE

**Active ingredient**  
Chlorpyrifos

**Formulation**  
Emulsifiable concentrate

**Insecticide group**  
Group 1B

**Target pests**  
A range of pests in a range of tropical crops

**Activity**  
Contact

**Packaging**  
1 L, 5 L and 20 L containers

**Application rate**  
See label as rates vary with pest and crop

### KEY FEATURES

- Fast acting.
- Low persistence after application.
- Well established reputation of proven product performance (38 year history).

### APPLICATION & USE

- Apply as soon as infestations are detected.
- Ensure spray volume is adequate to provide complete coverage to the point of run-off.
## CROP PEST READY REFERENCE GUIDE

<table>
<thead>
<tr>
<th>Pest</th>
<th>Avocados</th>
<th>Bananas</th>
<th>Citrus</th>
<th>Mangos</th>
<th>Pineapples</th>
<th>Stone Fruit</th>
<th>Strawberries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avocado leafroller</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana scab moth</td>
<td></td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana weevil borer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California red scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common mango scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Field crickets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

*Lorsban™ INSECTICIDE*

**CONTENTS**

PEST MANAGEMENT
# CROP PEST READY REFERENCE GUIDE

<table>
<thead>
<tr>
<th></th>
<th>Avocados</th>
<th>Bananas</th>
<th>Citrus</th>
<th>Mangoes</th>
<th>Pineapples</th>
<th>Stone fruit</th>
<th>Strawberries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ivy leafroller</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mole cricket</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pineapple mealybug</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Jose scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White grub</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Avocados, Bananas, Citrus, Passionfruit and Stone fruit**

**PRODUCT PROFILE**

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Chlorpyrifos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulation</td>
<td>Wettable granule</td>
</tr>
<tr>
<td>Insecticide group</td>
<td>Group 1B</td>
</tr>
<tr>
<td>Target pests</td>
<td>Queensland fruit fly and</td>
</tr>
<tr>
<td></td>
<td>Banana weevil borer</td>
</tr>
<tr>
<td>Activity</td>
<td>Contact and ingestion</td>
</tr>
<tr>
<td>Packaging</td>
<td>3 kg containers</td>
</tr>
<tr>
<td>Application rate</td>
<td>See label as rates vary with pest and crop</td>
</tr>
</tbody>
</table>

**KEY FEATURES**

- Fast acting.
- Low persistence after application.
- Excellent fruit finish.
- Well established reputation of proven product performance (38 year history).

**APPLICATION & USE**

- When bait spraying to control Queensland fruit fly, spray low on tree or vine every 7–10 days avoiding contact with fruit.
**Naturalure™ FRUIT FLY BAIT CONCENTRATE**

*Fruit, Nut and Vine crops*

**PRODUCT PROFILE**

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Spinosad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulation</td>
<td>Bait concentrate</td>
</tr>
<tr>
<td>Insecticide group</td>
<td>Group 5</td>
</tr>
<tr>
<td>Target pests</td>
<td>Fruit fly (including Queensland fruit fly and Mediterranean fruit fly)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Ingestion</td>
</tr>
<tr>
<td>Packaging</td>
<td>4 L and 208 L containers</td>
</tr>
<tr>
<td>Application rate</td>
<td>1 L concentrate/ha</td>
</tr>
</tbody>
</table>

**KEY FEATURES**

- Approved for use on organic crops by Biological Farmers of Australia.
- Unique mode of action.
- Ideal for use in IPM programs (very safe to beneficial insects).
- Safe to crops.
- A nil withholding period.
- Highly favourable toxicology profile.

**APPLICATION & USE**

- Begin application as soon as monitoring traps indicate flies are present and repeat every 7 days or sooner if rain washes off the deposit.
- A large droplet size of 4000–6000 µ (4–6 mm) is recommended to optimise duration of the bait’s attractiveness to flies.
- Can be applied as a band or spot spray.
- Re-application is required if rain washes bait from foliage.
**Avocados, Citrus, Custard apples and Macadamia**

**PRODUCT PROFILE**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active ingredient</td>
<td>Methoxyfenozide</td>
</tr>
<tr>
<td>Formulation</td>
<td>Suspension concentrate</td>
</tr>
<tr>
<td>Insecticide group</td>
<td>Group 18</td>
</tr>
<tr>
<td>Target pests</td>
<td>Avocado leafroller, Lightbrown apple moth, Yellow peach moth, Macadamia flower caterpillar, Macadamia nutborer and Native budworm</td>
</tr>
<tr>
<td>Activity</td>
<td>Contact and ingestion</td>
</tr>
<tr>
<td>Packaging</td>
<td>1 L and 5 L containers</td>
</tr>
<tr>
<td>Application rate</td>
<td>See label as rates vary with pest and crop</td>
</tr>
</tbody>
</table>

**KEY FEATURES**

- Safe to all beneficial insects (ideal for IPM programs).
- Extended (14-21 days) residual activity on treated surfaces.
- Active on eggs and caterpillars.
- Excellent environmental and OH&S profile.
- Highly stable in water within a pH range of 4.0 and 9.0.
- Non-scheduled product.

**APPLICATION & USE**

- Can be applied as a dilute or concentrate spray.
- Target sprays against newly-hatched larvae or when numbers exceed spray thresholds.
- Make repeat applications as required.
- DO NOT apply more than 3 applications per season.
Success™ NEO
INSECTICIDE

Avocados, Bananas, Citrus, Custard apples, Mangoes, Lychees, Papaya, Passionfruit and Stone fruit

PRODUCT PROFILE
Active ingredient: Spinetoram
Formulation: Suspension concentrate
Insecticide group: Group 5
Target pests: A wide range of pests
Activity: Contact and ingestion
Packaging: 1 L, 5 L and 10 L containers
Application rate: See label as rates vary with pest and crop

INSECTICIDE

KEY FEATURES
• Unique mode of action (effective insect resistance management program partner).
• Safe to beneficial insects (ideal for use in IPM programs).
• Short withholding period.
• Highly favourable toxicology profile.

APPLICATION & USE
• Target sprays against mature eggs and newly-hatched larvae when numbers exceed spray thresholds.
• Make repeat applications at 7-14 day intervals as new infestations occur.
• DO NOT apply more than 4 applications per season.
• As part of a western flower thrip resistance management strategy, make only 3 consecutive applications per season.
# Pest Management

## Crop Pest Ready Reference Guide

<table>
<thead>
<tr>
<th>Fruit Type</th>
<th>Avocados</th>
<th>Bananas</th>
<th>Citrus</th>
<th>Mangoes</th>
<th>Stone fruit</th>
<th>Tropical and sub-tropical fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana rust thrip</td>
<td></td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cherry slug</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>•</td>
</tr>
<tr>
<td>Citrus leaf miner</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Flower-eating caterpillar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Heliothis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Leafroller</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lightbrown apple moth</td>
<td>•</td>
<td></td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CONTENTS

35
# CROP PEST READY REFERENCE GUIDE

<table>
<thead>
<tr>
<th></th>
<th>Avocados</th>
<th>Bananas</th>
<th>Citrus</th>
<th>Mangoes</th>
<th>Stone fruit</th>
<th>Tropical and sub-tropical fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looper</td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Large mango tip borer</td>
<td></td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oriental fruit moth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Red-banded thrip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Sorghum head caterpillar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Sugarcane bud moth</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western flower thrip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Yellow peach moth</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>●</td>
</tr>
</tbody>
</table>
WEED MANAGEMENT
**Gallery™ 750**
**DRY FLOWABLE HERBICIDE**

**PRODUCT PROFILE**
- **Active ingredient**: Isoxaben
- **Formulation**: Dry flowable
- **Herbicide group**: Group O
- **Crops**: Fruit and nut trees
- **Target weeds**: Broadleaf weeds
- **Activity**: Residual
- **Packaging**: 1 kg containers
- **Application rate**: 375–750 g/ha

**KEY FEATURES**
- Provides up to 6 months control of broadleaf weeds; and when used in conjunction with pendimethalin or oryzalin, provides season-long control of all weeds.
- Binds tightly to soil particles and will not leach into groundwater.
- Saves on hidden costs of using knockdown herbicides e.g. labour, water, machinery wear-and-tear and fuel.
- Prevents limited water in soil profile from being taken up by competitive weeds.

**APPLICATION & USE**
- Use the higher rate where weed pressure is high, or longer residual activity is required.
- Rain or irrigation (>12.5 mm) within 21 days is required to initiate product activation.
- When weeds are present at time of application, apply a suitable knockdown herbicide.
- **DO NOT** make more than 2 applications per 12 month period.
<table>
<thead>
<tr>
<th>PRODUCT PROFILE</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active ingredient</td>
<td>Oxyfluorfen</td>
</tr>
<tr>
<td>Formulation</td>
<td>Emulsifiable concentrate</td>
</tr>
<tr>
<td>Herbicide group</td>
<td>Group G</td>
</tr>
<tr>
<td>Crops</td>
<td>Fruit and nut trees</td>
</tr>
<tr>
<td>Target weeds</td>
<td>Broadleaf weeds and some grass weeds</td>
</tr>
<tr>
<td>Activity</td>
<td>Contact and residual</td>
</tr>
<tr>
<td>Application rate</td>
<td>See label as rates vary with weed and crop</td>
</tr>
</tbody>
</table>

**KEY FEATURES**

- Provides up to 4 months control of broadleaf and grass weeds.
- A new formulation with low volatility and low odour.
- Compatible with knockdowns, e.g. Ripper™ 480 Herbicide.
- Contains the same active ingredient as Goal™ Herbicide but at 2 X concentration.
- Incorporation easier to achieve.

**APPLICATION & USE**

- When applying GoalTender in a tank-mix with Ripper, DO NOT allow spray drift to contact any part of the plant, including the trunk.
- DO NOT apply once bud swell has occurred.
- Use the higher rates to obtain extended residual control.
PRODUCT PROFILE

Active ingredient: Glyphosate
Formulation: Soluble concentrate
Herbicide group: Group M
Target weeds: Grass and broadleaf weeds
Activity: Non-selective translocated
Packaging: 5 L, 20 L and 100 L containers
Application rate: 1.5-2.25 L/ha

KEY FEATURES

• Non-selective, non-volatile, water soluble liquid herbicide.
• Controls an extensive range of annual and perennial grasses and broadleaf weeds.
• Inactivated on clay and organic matter within the soil and therefore has no residual control.
• Rainfast 6 hours after application.
• Excellent compatibility profile.

APPLICATION & USE

• Use the lower rate when weeds are <15 cm tall.
• Only apply as a directed or shielded spray.
• DO NOT allow spray drift to contact any part of the plant, including the trunk.
## PRODUCT PROFILE

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Haloxyfop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulation</td>
<td>Emulsifiable concentrate</td>
</tr>
<tr>
<td>Herbicide group</td>
<td>Group A</td>
</tr>
<tr>
<td>Target weeds</td>
<td>Grass weeds</td>
</tr>
<tr>
<td>Activity</td>
<td>Systemic</td>
</tr>
<tr>
<td>Packaging</td>
<td>1 L and 5 L containers</td>
</tr>
</tbody>
</table>
| Application rate        | Annual grasses - 200-400 mL/ha  
                          | Perennial grasses - 400-800 mL/ha |

## KEY FEATURES
- Controls an extensive range of annual and perennial grass weeds.
- Rapid weed uptake.
- Low environmental impact.
- Well established reputation of proven product performance (23 year history).

## APPLICATION & USE
- The addition of an adjuvant to the spray mix is required (Uptake™ Spraying Oil is recommended).
- Use a minimum water volume of 50 L/ha although higher volumes (150 L/ha) are recommended.
- Spray should be directed at the base of the tree or vine avoiding contact with fruit or foliage.
# PRODUCT COMPATIBILITY GUIDE

<table>
<thead>
<tr>
<th>Compatible with</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applaud, Delegate and Dithane Rainshield Neo Tec</td>
<td>Most commonly used fungicides and insecticides. (Applaud NOT compatible with Sacoa BioPest® Oil).</td>
</tr>
<tr>
<td>Gallery 750</td>
<td>Products containing only oryzalin or only pendimethalin.</td>
</tr>
<tr>
<td>GoalTender</td>
<td>Basta®, glyphosate products, oryzalin (500 g/L), diquat, paraquat and diquat/paraquat.</td>
</tr>
<tr>
<td>Indar</td>
<td>Most commonly used agriculture fungicides, insecticides, growth regulators, micronutrients and spray adjuvants.</td>
</tr>
<tr>
<td>Lorsban 500EC, Lorsban 750WG</td>
<td>Fungicides: Carbarly, chlorothalonil, cypermethrin, diazinon, dicofol, dimethoate, esfenvalerate, maldison, methidathion, methomyl, oils, thiram, triadimefon, trichlorfon, zineb and ziram.</td>
</tr>
<tr>
<td>Prodigy</td>
<td>Most commonly used fungicides, insecticides and foliar fertilisers.</td>
</tr>
<tr>
<td>Success² NEO</td>
<td>Applaud, carbendazim, copper hydroxide, Dithane, fenarimol, flusilazole, iprodione, methomyl, metalaxyl-M + mancozeb, metiram, pyrimethanil, sulphur, tebuconazole and thiram.</td>
</tr>
<tr>
<td>Naturalure</td>
<td>DO NOT mix with any other pesticides.</td>
</tr>
<tr>
<td>Ripper 480</td>
<td>GoalTender, oryzalin, pendimethalin, simazine and trifluralin.</td>
</tr>
<tr>
<td>Verdict 520</td>
<td>Oryzalin and simazine.</td>
</tr>
</tbody>
</table>

*Note: Since product formulation specifications of other manufacturer’s products may change without Dow AgroSciences being notified, a physical check prior to application is recommended.*
## PRODUCT HARVEST WITHHOLDING PERIODS
### DOMESTIC MARKET

<table>
<thead>
<tr>
<th>Product</th>
<th>Harvest Withholding Period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Harvest Withholding Period</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Applaud</strong></td>
<td>Citrus and Mangoes - Do not harvest for 28 days after application. Custard apples - Do not harvest for 14 days after application. Passionfruit - Do not harvest for 1 day after application.</td>
</tr>
<tr>
<td><strong>Delegate</strong></td>
<td>Stone fruit - Do not harvest for 3 days after application.</td>
</tr>
<tr>
<td><strong>Dithane Rainshield Neo Tec</strong></td>
<td>Bananas and Citrus - Not required when used as directed. Custard apples, Mangoes and Papaya - Do not harvest for 1 day after application. Passionfruit and Stone fruit - Do not harvest for 14 days after application.</td>
</tr>
<tr>
<td><strong>Indar</strong></td>
<td>Bananas and Nectarines - Do not harvest for 1 day after application.</td>
</tr>
<tr>
<td><strong>Lorsban 500EC</strong></td>
<td>Avocados - Do not harvest for 7 days after application.</td>
</tr>
<tr>
<td><strong>Lorsban 750WG</strong></td>
<td>Bananas, Citrus, Passionfruit and Stone fruit - Do not harvest for 14 days after application.</td>
</tr>
<tr>
<td><strong>Naturalure</strong></td>
<td>Not required when used as directed.</td>
</tr>
<tr>
<td><strong>Prodigy</strong></td>
<td>Avocados, Custard apples and Lychees - Do not harvest for 14 days after application. Citrus - Do not harvest for 1 day after application. Macadamia - Do not harvest for 28 days after application.</td>
</tr>
<tr>
<td><strong>Success² NEO</strong></td>
<td>Bananas, sub-tropical and tropical fruit (excluding Kiwi fruit) - Not required when used as directed. Kiwi fruit - Do not harvest for 7 days after the last application.</td>
</tr>
</tbody>
</table>
Effective and efficient application of pesticides is essential for continued profitable production of high quality fruit and vegetables. It will also minimise chemical residues on produce and the amount of chemical ending up off-target in the environment.

Recommendations for Dilute Spraying (to the point of first run-off) are expressed in amount of product per 100 litres of water. No rate for Concentrate Spraying is provided. Instead, when concentrate spraying; the same amount of product should be applied to the target canopy as would be applied in a dilute application to the point of first run-off. A statement on the suitability for concentrate spraying will normally be supplied in the Mixing/Application section on the label.

Whenever applying chemicals it is important to consider:

- Application Timing - Applying the right chemical at the right time within an integrated pest management strategy.
- Application Rate - Applying the correct rate (calibration).
- Spray Coverage - Achieving effective coverage (sprayer set-up).
Dilute Spraying

- Use a sprayer designed to apply high volumes of water to the point of first run-off in as many parts of the canopy as possible, with coverage that is as even as possible throughout the crop. Avoid excessive run-off. This is called the required dilute spray volume.

- The required dilute spray volume of water may be determined by applying different test volumes, using different settings on the sprayer, from industry guidelines or by getting expert advice.

- Add the amount of product as specified in the DIRECTIONS FOR USE table for each 100 L of water.

- The required dilute spray volume will change with canopy size, density and structure, the sprayer type, and sprayer set-up and operation. As the canopy grows during the season and the trees age, so too will the required dilute spray volume need to change.
## Canopy Size Calibration Chart for Tree Crops (excluding citrus) - Required Dilute Spray Volume (litres/100 m of row)

The indicative water volumes in the chart are **for guidance only**. Water rates for each canopy type MUST be determined using the calibration system described on page 45.

**NOTE**: When measuring tree canopies, ignore sparse branches protruding in any direction and measure to where the canopy is reasonably continuous.

<table>
<thead>
<tr>
<th>Tree Height (metres)</th>
<th>Sparse Canopy</th>
<th>Dense Canopy</th>
<th>Required Dilute Spray Volume (litres per 100 metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1m</td>
<td></td>
<td></td>
<td>35 to 55</td>
</tr>
<tr>
<td>2m</td>
<td></td>
<td></td>
<td>70 to 110</td>
</tr>
<tr>
<td>3m</td>
<td></td>
<td></td>
<td>105 to 165</td>
</tr>
<tr>
<td>4m</td>
<td></td>
<td></td>
<td>140 to 220</td>
</tr>
</tbody>
</table>
Concentrate Spraying

• Use a sprayer designed and set-up for concentrate spraying (i.e. A sprayer which applies water volumes just less than that required to reach the point of run-off).
• Set up and operate the sprayer to achieve reasonably even coverage throughout the canopy using your chosen spray volume.
• Determine the required dilute spray volume (see Dilute Spraying on page 45) for the crop canopy. Consult your local advisor, agronomist or Department of Primary Industries for help in determining this volume. This is needed to calculate the concentrate mixing rate.
• The mixing rate for concentrate spraying can then be calculated in the following way:

*Example only*
- Dilute spray volume as determined above e.g. 1500 L/ha.
- Your chosen concentrate spray volume e.g. 500 L/ha.
- The concentration factor in this example is therefore 3 (i.e. 1500 L ÷ 500 L = 3).
- If the dilute label rate is 25 mL/100 L, then the concentrate rate becomes 3 × the dilute rate i.e. 75 mL/100 L of concentrate spray.

• The chosen spray volume and sprayer set up and operation may need to be altered as the crop grows.
• For further information on concentrate spraying, consult relevant industry guidelines.
• Always follow spraying Best Practices.