

OLIVE



› **Think**
Innovation

› **Trust**
Quality

› **Expect**
Performance



S A C O A

About This Booklet

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About This Booklet

This booklet provides practical information to assist in the effective and safe use of **BIOPEST**[®].

What Is **BIOPEST**[®]?

BIOPEST[®] is a revolution in spray oil technology. Offering a unique level of 'purity'

BIOPEST[®] is registered as a pesticidal adjuvant and an off-label permit (PER3821) exists for its use in the control of a variety of scale pests in olives.

A Focus on SACOA

SACOA is an Australian company that have specialised in the development and supply of spray oils and adjuvants for the past ten years.

To ensure we deliver world quality product we partner with leading suppliers and researchers.

Groups such as the **University of Western Sydney** (research), **Huntsman** (surfactants) and **SK Corporation** (base oils) are all working with us to ensure our products stay at the forefront of spray oil technology.

More information is available at <http://www.sacoa.com.au>.

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Quality defines effectiveness and crop safety.

How **BIOPEST**[®] Works ... p3

BIOPEST[®] can act at a number of levels.

What 'Behaviour Modification' Is... p6

BIOPEST[®] can modify egg laying and feeding behaviour.

How To Use **BIOPEST**[®] ... p7

Spray rates, volumes, frequency, mixing etc are all covered.

What **BIOPEST**[®] is Compatible With ... p10

Lists all popular chemicals and their compatibility.

What **BIOPEST**[®] Can Help Control ... p11

Focuses on major olive fungal diseases and pests.

How To Ensure Crop Safety... p19

Important advice on protecting against fruit or tree damage.

When To Spray For Particular Pests... p21

Practical monitoring and spray timing information.

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Quality = Effectiveness + Safety

The quality of the spray oil you use will define two things:

- How effective it will work in assisting in the control of certain fungal diseases and pests.
- How safe it will be to the fruit and tree.

It's Clear

BIOPEST[®] is a revolution in spray oil quality.

Produced from food-grade iso-paraffinic oil

BIOPEST[®]'s clarity is a clear sign of its quality and purity.

The next time you open a drum of oil, check its clarity.

Is it 'water clear'?



BIOPEST[®]'s purity is perfectly clear.

And Pure

BIOPEST[®] is rated at over 98.0% pure - the highest practical level achievable with current refining technology. This is a higher purity than any other spray oil product on the market (based on published USR levels).

How do we measure purity?

By USR - USR stands for UnSulphonated Residue and measures the absence of potentially damaging impurities in oils. The **lower** the USR % the higher the risk of plant damage.

The 'impurities' are generally a grower's worst enemy when applying spray oils. Impurities, when exposed to sunlight, oxidise and form acids on the leaf and fruit surfaces and in certain conditions 'burn' the plant.

Lighter oils may reduce the impact of impurities, though also offer less potential efficacy. How **BIOPEST**[®], an optimal weight oil, avoids this tradeoff is discussed in detail on page 2.

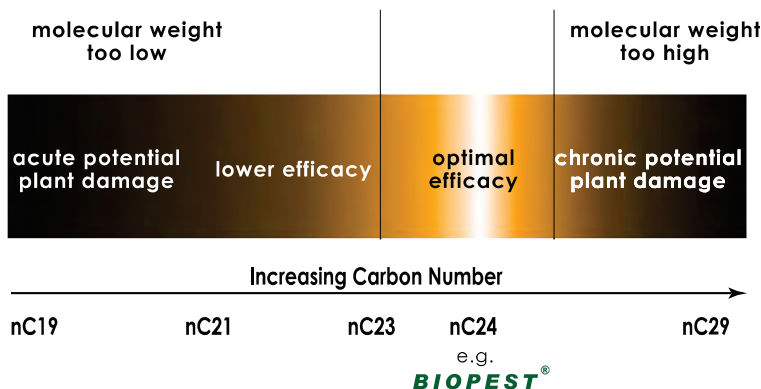
The Tradeoff Between Efficacy and Plant Safety

The general rule with mineral spray oils has been that heavier oils are optimal for efficacy but carry a greater risk of plant and fruit damage. Until now.

Using Carbon Number to Compare Oils

Carbon number (e.g. nC24)

measures the number of carbon atoms in each molecule of oil and is used to indicate an oil's 'weight'. This is a key measure of an oil's potential efficacy and an indicator of the potential for plant damage (other factors also apply).



Optimal Efficacy Plus Safety

A lighter oil may be less effective, though there is also less potential to damage the plant as a lighter oil volatilises (evaporates) more rapidly.

BIOPEST[®] is rated as an nC24 oil. As such it provides greater efficacy and due to its unique purity it does not provide any increased risk of plant damage. It may in fact offer reduced potential when compared to lower quality, lighter oils.

Why does **BIOPEST**[®] Work Better?

BIOPEST[®] offers a uniquely pure, optimal weight oil without the potential plant damage tradeoff.

A Pure Oil	+	Optimal Weight	+	Quality Surfactant	=	Efficacy + Safety
USR over 98% <i>Impurities cause damage the longer they stay on the plant surface.</i> BIOPEST [®] 's USR rating of over 98% means it can stay on the plant surface and keep working without damaging the plant or restricting growth.		nC24 BIOPEST [®] persists on the leaf or fruit surface longer. This means: - More pests killed. - Significantly greater effectiveness in modifying the behaviour of pests.		Biodegradable <i>Improves the sticking and spreading properties of the oil in a rapidly biodegradable formula.</i>		More pest control per spray and for longer with less risk of plant or fruit damage.

BIOPEST[®] - A Revolution in Spray Oil Technology

SACOA *BIOPEST*[®] Paraffinic Oil is a highly refined food-grade iso-paraffinic oil formulation designed to assist the efficacy of other crop protection products.

BIOPEST[®] is registered in olives for use as an adjuvant to improve coverage and kill and an off-label permit exists for its use in the control of certain scale pests.

With an unmatched level of purity *BIOPEST*[®] represents the most advanced attempt yet to provide growers with an IPM product capable of controlling multiple, unrelated pests and fungal diseases simultaneously.

An Essential IPM Solution

BIOPEST[®], as an advanced biorational pesticide and adjuvant, is an essential olive IPM solution due to:

- PROVEN EFFECTIVENESS IN DISEASE AND PEST CONTROL
- SIMULTANEOUS MANAGEMENT OF A RANGE OF FUNGAL

DISEASES AND PESTS

- NO PEST RESISTANCE
- ABILITY TO MODIFY PEST BEHAVIOUR
- MINIMAL IMPACT ON BENEFICIAL INSECTS
- NOT PERSISTENT IN THE ENVIRONMENT
- LOW TOXICITY TO ANIMALS and GROWER
- SAFE TO HANDLE
- WON'T STIMULATE PEST OUTBREAKS



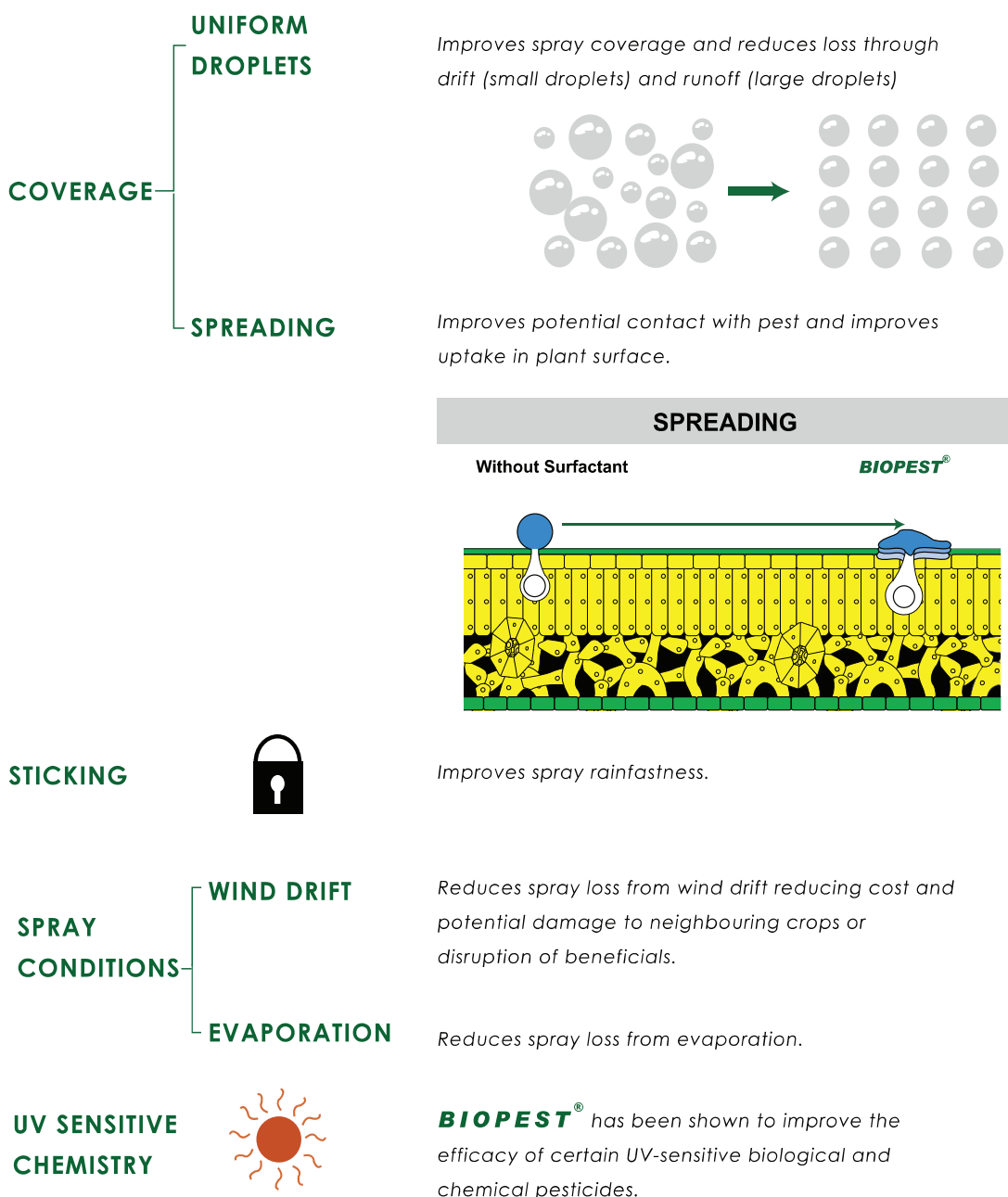
As mineral oils work at the physical level and not at the biochemical level, they do not invite resistance to develop. This valuable trait is supported by almost a century of mineral oil use in insect and disease control.

As A Carrier

BIOPEST[®] provides a unique combination of functions as a carrier for chemical and biological pesticides in olives.

These all work to:

- Get more of the chemical or biological active evenly onto the tree and fruit; and
- Protect the active and keeping it working longer.



Importance
of Quality

How **BIOPEST**[®]
Works

Behaviour
Modification

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BIOPEST[®]

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Olive Pests
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Ensuring
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Spray Timing
Chart

BIOPEST[®] - Three Key Modes of Action

As a biorational pesticide, **BIOPEST**[®] has three key uses in pest and disease management:

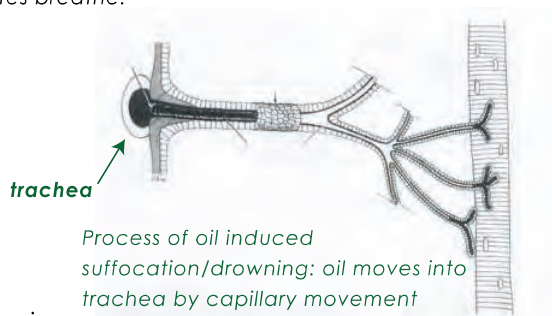
- Insecticide
- Fungicide
- Plant Virus Management

As an Insecticide

BIOPEST[®] effectively manages certain insect pests in two ways:

1. **BEHAVIOUR MODIFICATION** —————> **BIOPEST**[®] deters the feeding and egg laying of pest insects. How this occurs is covered in more detail in the section on behaviour modification.
2. **SUFFOCATION / DROWNING** —————> **BIOPEST**[®] blocks the air holes (spiracles) and lines the breathing tubes (tracheae) through which insects and mites breathe.

In some cases, **BIOPEST**[®] may also act as a 'poison', interacting with the fatty acids of the pest and interfering with normal metabolism.



As a Fungicide

BIOPEST[®] helps manage a number of different fungi in two ways:

1. **HOST PLANT PROTECTION** —————> It is believed that **BIOPEST**[®] may protect the host plant by interfering with the attachment of the fungi to the plant.
2. **ERADICATION OF FUNGI** —————> It is believed that **BIOPEST**[®] may help eradicate existing fungi by targeting and breaking down the fungi's cell walls.

As a Plant Virus Manager

BIOPEST[®] can be used to manage non-persistent viruses transmitted by sucking pests such as winged aphids by interfering with their feeding behaviour and hence disrupting the virus transmission process. As the viruses are generally transferred via the pests' stylet (the piercing and sucking mouthpart) it is prevented from inoculating healthy plants and transmitting virus from diseased ones.

'So significant are the behavioural effects of mineral oils that they should be regarded as the most important mode of action against arthropods.'

Prof. Andrew Beattie

New Learnings = New Opportunity

Extensive research by the University of Western Sydney has opened the door to a new understanding of how high quality mineral oil affects insects. It is now understood that high quality mineral oil can also modify certain key insect behaviours such as feeding and egg laying.

Insects shown to be potentially vulnerable include:

Whitefly	Codling Moth	Leafminer	Grape Leafhopper
Mites	Leafrollers	Aphids	Thrips
Fruit Fly	Psyllids	Budworm	Bollworms
<i>Helicoverpa spp.</i>		Lace bugs	

Source: University of Western Sydney

How Behaviour Modification Occurs

1. Plant feeding insects detect potential hosts through 'hairs' (sensillae) on their body.

We believe that in order to feed or lay eggs on a host plant, insects and mites must first detect a host plant at the chemical level. This is done through tiny, hollow hairs (sensillae) located on their mouthparts, feet and abdomen.

2. **BIOPEST[®] plugs these sensillae**

Inside the sensillae are nerve endings which are stimulated by specific chemicals produced within the host plant and are detected in the process of probing. We believe that contact with these chemicals can trigger or stimulate an insect to feed or lay eggs at specific locations within the plant.

3. This effectively 'blinds' the insect from communicating with the primary food source or oviposition site.



Beneficial Insects Are Minimally Affected

As beneficial insects are insect-attacking rather than plant-attacking they have evolved a different set of host detection mechanisms (such as mandibles, ovipositors, claws and large eyes) and are minimally affected.

A Proactive Approach is Best

Proactive spraying is essential to olive IPM programs and when using **BIOPEST**[®]. Set pest thresholds, monitor and spray when necessary (refer to Spray Timing Chart section for further details). This will avoid the expense of having to manage high or extreme pest levels.

In using **BIOPEST**[®] as a stand alone insecticide there are five key principles:

- High water volumes
- Rates of between 0.5% - 1.8%
- Ideally, multiple applications
- Thorough coverage of the plant
- Constant agitation in the tank

The following provides further detail on using **BIOPEST**[®] effectively.

RATES For multiple applications - 0.5% - 1.0%. *Specific levels for **rates** and water volumes will be influenced by:*

- Target pest
- Planting density
- Tree height
- Canopy density

WATER VOLUME For small to medium sized trees (i.e. to 3m): 2,000 - 5,000L per Hectare.
 For large trees (i.e. 3m +): 5,000 - 10,000L per Hectare.

SPRAY PRESSURE As a general rule spray for coverage of the upper leaf surface. Spray pressure will vary depending on the type of sprayer used.

We do not recommend adjusting spray pressure to change the litreage as this will affect the size of the spray droplet and possibly compromise coverage.

COVERAGE All parts of the tree and fruit must be completely covered in spray.

APPLICATIONS A multiple application approach is generally recognised as providing maximum pest control.

Single applications may also be used though may not provide adequate control on certain pests.

SPRAY FREQUENCY	Multiple applications at recommended rates at crucial times of the year are recommended.	<i>Will depend on pest pressure and pre-defined pest threshold levels.</i>
SPRAY TIMING	Refer to the Spray Timing Chart section for details.	
EQUIPMENT	Recommended: - Oscillating boom with a horizontal outrigger Will work adequately: - Air-blast sprayers with towers - Rotary atomisers on towers Not Recommended: - Low-profile air-blast sprayers - Mist Blowers - Electrostatic sprayers	<i>Mist Blowers and electrostatic sprayers are generally unsuitable, as coverage will be compromised from lack of dilute spray volume.</i>
TRACTOR SPEED	Adjust tractor speed to achieve thorough spray coverage to the point of runoff. This may be 2 - 3km/h on large trees.	
RE-ENTRY INTERVAL	Four hours.	
PRE-HARVEST INTERVAL	Twenty four hours.	
MAXIMUM RESIDUE LIMITS	BIOPEST [®] has no maximum residue limits as it is produced from food-grade raw materials.	

Mixing Instructions

Importance
of Quality

- Add water to the mixing tank to allow proper agitation by pump or paddles.
- If **BIOPEST**[®] is being used as an adjuvant, add other pesticides as follows:
 - If a wettable powder formulation: Mix water and powder thoroughly so that

How **BIOPEST**[®]
Works

powder is totally suspended in the water before the oil

is added.

- If an emulsifiable formulation: Add before the oil has been added to the water.

Behaviour
Modification

- Add oil under agitation when tank is half full. Top off with water to form a milky solution.
- Maintain agitation until solution is completely used.

How To use
BIOPEST[®]

- In small equipment lacking agitators, stir or shake diluted spray frequently during applications.

Compatibility
Chart

- Read and follow all instructions on the labels of the proposed tank mix.
- Flush fluid in sprayer hose lines back into tank reservoir if fluid is allowed to stand for more than 20 minutes.

NOTE: Do not use **BIOPEST**[®], or any other spray oil with lime sulphur, propargite, or any other product containing sulphur.

Olive Pests
and Diseases

Three Important Points

In addition to following the correct mixing order three considerations are always critical to tank mixing:

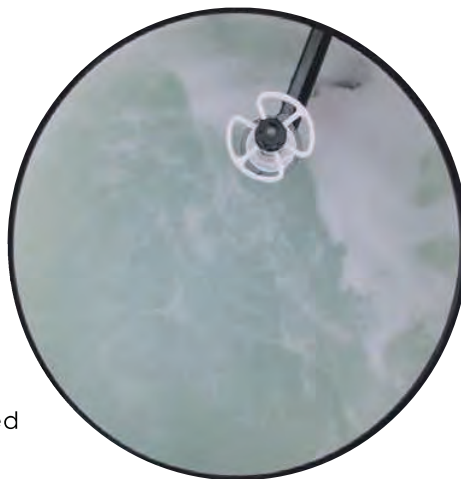
Ensuring
Crop Safety

1. Refer to Product Label: Always read the product label prior to use to determine individual product compatibility options and to confirm correct mixing orders.

2. Perform a Jar Test: It is always advisable to perform a premix jar test to confirm physical compatibility. Physical compatibility does not always ensure biological compatibility.

Spray Timing
Chart

3. Agitation: Use constant agitation in the spray tank. Use either mechanical or bypass agitation to ensure the oil remains an emulsion in the tank. Never leave a spray tank of oil + water overnight to be sprayed out the next day.



Mixing Compatibility

The following table shows popular chemical used in olives that are chemically compatible with **BIOPEST**[®], and other mineral oils. Ensure label recommendations are followed. Those that should not be mixed are highlighted.

CHEMICAL	COMPATIBLE
alpha-cypermethrin	yes → <i>On non-bearing trees only</i>
BTs	yes
chlorpyrifos	yes → <i>Trunk applications only</i>
copper hydroxide	yes
copper oxychloride	yes
dimethoate	no
endosulfan	yes → <i>Endosulfan should only be applied to tree trunks for the control of ants.</i>
fenthion	yes
lime-sulphur	no
mancozeb	yes
methidathion	yes
natrasoap	no
omethoate	yes



A Caution On Multiple Mixes

Tank mixes involving multiple chemicals should be avoided where possible due to the difficulty in calculating their combined effect on pests, plant, soil and environment.

This section covers key scale, bug and mite pests affecting olive groves.

Importance
of Quality

BIOPEST[®]'s Potential Role - Scale Pests

An off-label permit exists for all states except Victoria for the use of spray oils such as BIOPEST[®] to control a variety of scale pests found in olives. This permit was in force until August 2005. The permit rate is 1.8 to 2.5L per 100L of water.

How BIOPEST[®]
Works

Black Scale (*Saissetia oleae*)

Black Scale are the main scale insect pest of olives. Adult females are about 3-5 mm in diameter. They are dark brown or black with a hard, prominent H-shaped ridge on the back and can lay up to 2000 eggs, which hatch over several weeks.

Behaviour
Modification

Increased ant activity often indicates hatching periods. Ant control will help to keep scale populations low. Ants feed on the honeydew produced by the scales, frighten away the natural enemies of scale and may also move crawlers from one plant to another.

How To use
BIOPEST[®]

Crawlers are active and can be found on the olive trees during early spring/summer. Young scales are yellow to orange and can be seen on leaves and twigs of a tree. A hand lens is usually needed to detect the crawlers.

Compatibility
Chart

Black scale prefers dense, unpruned portions of trees. Open, airy trees rarely support heavy populations of black scale.

Olive Pests
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DAMAGE: Young black scales excrete sticky, shiny honeydew on leaves of infested trees. At first, affected trees and leaves glisten and then become sooty and black in appearance as sooty mould fungus grows on the honeydew. Infestations reduce vigour and productivity of the tree.

Ensuring
Crop Safety

Continued feeding reduces foliage and fruit the following year. These may also cause twig dieback.

Spray Timing
Chart



Adult female black scale

Black Scale - Cont'd

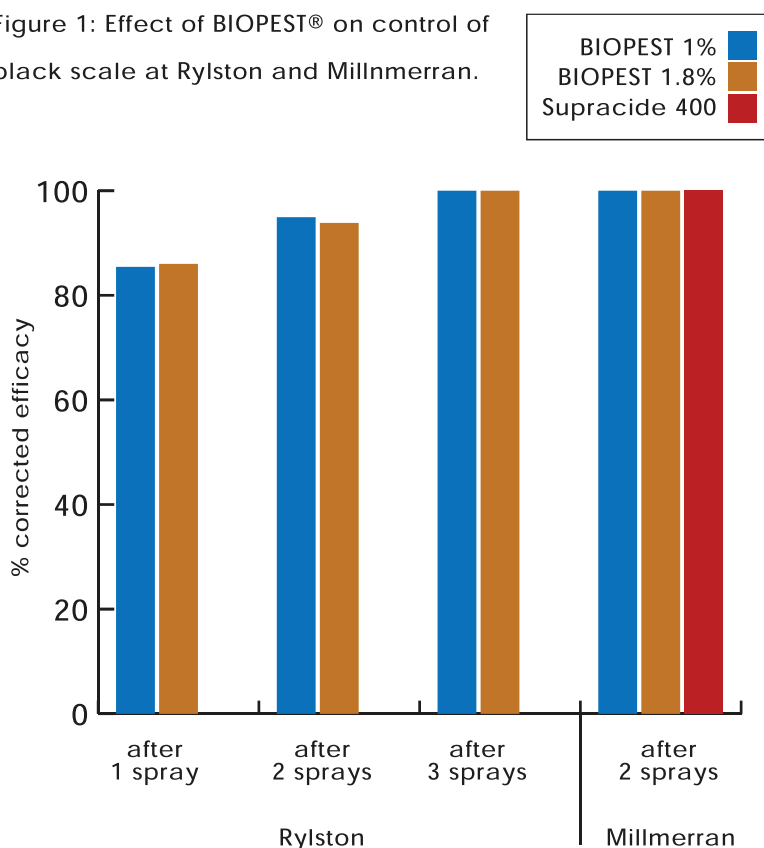
WHEN TO TREAT: The first indication of black scale is usually the presence of honeydew on the leaves and ant activity. Trees should be sampled to get an indication of population levels. For moderate to severe infestations an application of **BIOPEST**[®] at 1.2L - 1.8L/100L should be applied twice, 2-4 weeks apart, possibly in conjunction with soda ash for severe infestations. Check labels for rates.

Research Highlights Safer Black Scale Solution

Studies conducted by the University of Western Sydney evaluated **BIOPEST**[®] for control of black scale. Experiments conducted at Millmerran (Qld) and Rylston (NSW) over 2 years tested 2 concentrations of **BIOPEST**[®]; 1.8% as prescribed by the Permit and a lower concentration of 1% in high volume sprays of between 4 and 10 L per tree (depending on the size of the tree). In Millmerran the effectiveness of the oil was compared with Supracide[®].

THE RESULTS: Results demonstrated that multiple sprays (2-3 sprays) of 1% **BIOPEST**[®] with an interval of 3-4 weeks between sprays fully controlled black scale (refer Figure 1) and this level of control was the same as that achieved with the Schedule 7 Poison Supracide[®]. The use of **BIOPEST**[®] did not reduce yield or influence oil quality. **BIOPEST**[®] offers the following additional benefits over Supracide[®]: No withholding period, no pest resistance issues, minimal impact on beneficial insects, safe for the user.

Figure 1: Effect of **BIOPEST**[®] on control of black scale at Rylston and Millmerran.



Corrected efficacy (%) is calculated using the Henderson and Tilton formula.

California Red Scale (*Aonidiella aurantii*)

California red scale is similar to adult olive scale. The adult female has a thin, circular shell, 2.5mm in diameter. The reddish body colour is visible through the shell.

DAMAGE: California red scale does not discolour fruit, which distinguishes its damage from that of olive scale and oleander scale. All parts of the olive tree are infested. Infested fruit are rendered worthless.

WHEN TO TREAT: Apply first treatment when scale crawlers are seen moving on to the fruit. Treating scales between hatchings is not recommended. A postharvest treatment is also effective in assisting control.



Female black scale eggs and hatchlings

Oleander Scale (*Aspidiotus nerii*)

The adult female oleander scale is about 2.5mm long, oval, with a waxy covering that is whiter than olive scale, and has a yellow or light brown spot near the centre. The adult male scale is elongate. If the coverings are removed, the female body is yellow, while the male scale is brownish yellow. This scale is most common on leaves and branches in the lower part of the tree.

DAMAGE: The oleander scale infests olive fruits and delays maturity at the spot where they occur. Thus, damage is seen as prominent green spots on purple fruit, in direct contrast to damage caused by olive scale. Heavy infestations seriously deform fruit, can reduce oil content by up to 25%, and fruit spotting renders the olive worthless as table olives. They can also damage trees via injection of toxins into the plant.

WHEN TO TREAT: Biological control usually keeps oleander scale populations at low levels. Though if treatments are necessary, apply the first treatment when young scales are observed moving onto fruit. Treating scales between late hatchings, is not recommended. A postharvest treatments should also be effective.

Olive Lace Bug (*Froggattia olivinia*)

Olive lace bug is increasingly being recognised as a major olive pest in Australia. The insect is native to New South Wales and southern Queensland, but currently has a distribution throughout eastern Australia and South Australia, and has recently been detected in Western Australia,

SACOA and the University of Western Sydney are currently undertaking field trials looking at the potential that *BIOPEST*[®] offers to the control of this pest at the first, second and third instar stages, when they are most susceptible. Interim results are encouraging and it is hoped that *BIOPEST*[®] may be registered for the control of the olive lace bug by the end of 2003 or when the current permits expire.

DESCRIPTION OF THE PEST: The olive lace bug is so named due to the lace like texture on the wings of the adults. The adults are mottled (dark brown & cream) and approximately 3mm in length, with long, black-tipped antennae. The olive lace bug can have 3 - 4 generations a year with adults emerging after just 5-6 weeks from the eggs hatching. Female lace bugs lay their eggs along the leaf mid-vein, covering them with a black tar like excreta. The nymphs develop through multiple instars (nymphal stages) and are oval shaped and wingless at first, with wing buds progressively developing from the 3rd instar onwards. They are often clustered on the undersides of leaves. There are no known important natural predators of this pest.

DAMAGE: Although most olive lace bug activity occurs on the underside of the leaf, the most common indications of activity are observed from the upper leaf surface where leaves become stippled with greenish to rusty yellow dots. The yellowing on upper leaves is frequently associated with blackness and dirty smears (excrement) on the underside of leaves.

In the absence of adult olive lace bugs, damage may easily be confused with thrips or mite damage. However, close examination shows that at least some of the spots are incomplete rings (3 or C-shaped) smaller than 1 mm over the widest diameter. The protruding egg caps are also distinctive, but a magnifying device (minimum 10X magnification) is required.

Recent data from the University of Western Sydney indicates that trees stressed by severe infestations may fail to bear fruit in subsequent years. This is potentially a serious economic consequence for the developing Australian olive industry.

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Olive Lace Bug - Cont'd

WHEN TO TREAT: Currently there is a NRA Permit for the use of Fenthion, Dimethoate and Natrasoap. The withholding periods must be observed, especially if sprayed on bearing trees to be harvested that season. Soap sprays have limited efficacy against later instars.

Insecticides are not very effective against eggs and work best 7-10 days after the eggs have hatched, normally in September and October.

However, with research results indicating that breeding continues throughout winter, it is essential that monitoring for early signs of damage to trees should be ongoing throughout the season. A follow up application with an alternative insecticide (to fit in with permit guidelines) two weeks after the first application may be required to control heavy populations. Thorough coverage, especially directed to the under surface of leaves, is essential for good control.

Olive Bud Mite (*Oxycenus maxwelli*)

The olive mite occurs throughout all commercial olive districts in Australia after recently being introduced from California. The olive tree, *Olea europaea*, is the preferred host. Olive mite is an eriophyid mite and is extremely difficult to see without magnification. The mite is yellowish to dark tan, slow moving, and pyriform in shape, typical of many eriophyid species.

As **BIOPEST**[®] offers proven performance in the control of certain mites in other crops, SACOA are conducting research work with industry research members so that **BIOPEST**[®] will be registered for the control of this common olive pest. There are currently no permitted pesticides for its control.

DAMAGE: As a rule, this pest is not a major problem. Olive mites feed on succulent stem and bud tissues and on the upper surface of leaves. Gross symptoms of mite damage include sickle-shaped leaves, dead vegetative buds in spring, discolouration of flower buds, bud drop, blossom blasting, inflorescence abscission, reduced shoot growth, reduced internodal lengths leading to a 'witches' broom' effect..

WHEN TO TREAT: If fruit set and cropping have been normal over the years, do not treat. If unexplained, abnormally low cropping has chronically occurred several years in a row, especially when associated with brown, desiccated bloom, look for olive mites on flower buds in spring. Treat prior to bloom if large populations of olive mite are present on developing flowers.

BIOPEST[®]'s Potential Role - Fungal Diseases

Post-harvest copper sprays can significantly benefit from being combined with BIOPEST[®]. BIOPEST[®] will help the fungicide with rain fastness, improved coverage and proper adhesion to the tree's surfaces as well as assisting with the control of a variety of scale insects.

Note re oil olives and copper spraying: If you intend to sell olives for oil, consult with your processor as to acceptability of copper treated fruit before any treatment is made.

Peacock Spot (*aka Olive Leaf Spot*)

Key points:

- A leaf disease caused by a fungus, outbreaks are sporadic.
- Infection is associated with rainfall and high humidity during first autumn rains and early winter.
- The fungus survives on trees in old leaf lesions and fallen leaves that have a white, crusty appearance.
- Lesions usually observed on upper leaf surface. Fruit can also be attacked.
- Small sooty splotches usually appear in winter and develop into yellow-greenish black circular spots.
- Most infected leaves will fall during summer.

Post harvest is the time to prevent this and other important olive diseases. Copper compounds such as Copper Hydroxide and Copper Oxychloride are permitted as foliar sprays for control of several fungal and bacterial diseases of olives. Copper, applied prior to winter rain in conjunction with BIOPEST[®], prevents infection from the Peacock Spot fungus. It is important that applications be made before autumn/winter rains as copper only provides protection and does not cure established infections.

Once the autumn application of copper is applied, additional applications may not be necessary for Peacock Spot control. Further follow up treatments will be required in the spring period for fruit disease Anthracnose (soft nose).

It is also important to clean up and mulch fallen infected leaves in late autumn/early winter.

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Anthracnose

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Anthracnose is the term given to plant tissue damage caused by a particular strain of *Glomerella cingulata* (may also be caused by *Colletotrichum gloeosporioides*). It primarily affects olive fruit.

How BIOPEST[®]
Works

Recently *Colletotrichum acutatum* has also been found on rotted fruit. It causes a soft circular rot on the fruit, usually on the shoulder, and at high humidity produces an orange slimy mass of spores on the fruit surface. It is difficult to determine exact cause and time of infection, as *Alternaria*, *Cladosporium*, and *Ulocladium* have also been associated with the end or nose rots seen on several cultivars, though it is more likely as secondary infections.

Behaviour
Modification

Whilst it is a latent fungus, primarily showing symptoms as fruit ripens, it affects fruit at all stages. This includes fruit damaged or stressed by poor picking practices, by sun and spray burn, fruit that is overripe or held for too long in storage. These fungi can be both primary and secondary invaders, and further research needs to be undertaken to confirm their importance as pathogens.

How To use
BIOPEST[®]

Compatibility
Chart

Other causes of fruit rots such as 'soft nose' observed on the stylar end of Sevillano cultivars, may be associated with water stress, heavy nitrogen fertilisation and an imbalance of nutrients including calcium and boron. It can also be attributed to sudden changes in temperature and humidity which produce partial dehydration of olive fruit, particularly at the apical end.

Olive Pests
and Diseases

BIOPEST[®] will assist in the control of anthracnose in its role as a carrier for copper sprays. Application rates should be according to label recommendations. Refer to the Spray Timing section in this booklet for further details.

Ensuring
Crop Safety

Spray Timing
Chart

Avoiding Plant or Fruit Damage

The following paragraphs cover some important notes concerning crop safety when using **BIOPEST**[®] in olives.

Ensure Optimum Soil Moisture

Water-stressed trees are more susceptible to burn from pesticides including spray oils.

To minimise the chance of this occurring soil moisture should be at a optimum level before application. Spray as soon after an irrigation as the ground will permit operation of the equipment. Be sure to maintain adequate soil moisture from spring throughout the entire irrigation season.

Avoid Extreme Temperatures

Do not spray oils if temperatures will exceed 32°C during the day or relative humidity falls to 20% or below (in coastal regions, do not spray if the temperature will exceed 28°C to 32°C or the relative humidity goes below 30%). Do not use oil sprays immediately before, during, or following an unusually cold weather period.

Ensure Complete Spray Coverage

Coverage of the entire olive tree is essential. Some scale, mite or insect eggs can escape the suffocation by the spray because of poor coverage of the top of the tree where limbs are upright and oil does not reach the narrow crotches. Limb stubs left behind from pruning are also areas that may not be covered. Always thin out upright limbs and make cuts as close to limbs as possible.

A guide to rates & volumes for specific tree sizes is as follows.

Tree Height	Litres/tree*
2.5 to 3.5 metres.....	5 to 15
3.5 to 5.5 metres.....	15 to 20
5.5 metres or higher...	20 to 30

**Use lower amounts on trees, which have little or no leaf exposure.*



Avoiding Plant or Fruit Damage - *Cont'd*

Timing Copper Sprays

No copper sprays should be done during flowering.

Avoid Insoluble Powders

When mixing with an oil spray, use liquid or water-soluble formulations of pesticides instead of insoluble powders whenever possible; insoluble powder affects interfacial surface relations and stability of dilute spray mixtures as well as the spreading and availability of oil in the spray deposit. If unavoidable, do not add more than 750g of insoluble powders per 100L of dilute oil spray mixture (as per the product label). Also, do not put the powders into the tank until the dilute mixture is above the three quarter level.

Soda Ash

The use of soda ash and spray oil such as **BIOPEST**[®] for the control of some severe infestations and hard to kill scale insect pests has been recommended. The correct rates of application in these instances is 750g/100L (as per the product label).

Application of Methidathion (Supracide[®])

Do not apply Methidathion with, or closely following, a fungicide containing lime, as it will negate the insecticide's effectiveness. Methidathion is highly toxic to humans, other mammals, aquatic life, and the environment, and should only be used when scales are at heavy infestation levels, or all other treatments have been exhausted. Furthermore, methidathion should not be necessary if using IPM programs based on natural enemies and quality oils such as **BIOPEST**[®].

Spray Timing - Fruit Growth Stage

The following table outlines suggested spray timings and spray rates for key olive pests and diseases based on fruit growth stages. This table should be read in conjunction with the spray timing chart on the following page. Always refer to product labels for correct rates and usage terms.

Time of Application	Disease/Pest	Spray Material	Concentration /100L	Comments
After flowering during fruit set	Anthracnose Mites and scale	Copper + <i>BIOPEST</i> [®]	500g/100L 600mL	
Fruit half developed	Anthracnose Mites and scale	Copper + <i>BIOPEST</i> [®]	500g/100L 600mL	Recommended only for severe infections. Spray in cool weather (<32°C) e.g. early morning or evening as tissue damage may occur with copper.
Fruit fully developed but before discolouration	Anthracnose	Copper + <i>WETTA1000</i>	200g/100L	CAUTION: As the residue levels can affect oil quality, this treatment is only recommended for severe infections.
Post harvest hygiene spray	Anthracnose Peacock spot Scale	Copper + <i>BIOPEST</i> [®]	400g/100L 600mL	Before winter rains.



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Importance
of Quality

How *BIOPEST*[®]
Works

Behaviour
Modification

How To use
BIOPEST[®]

Compatibility
Chart

Olive Pests
and Diseases

Ensuring
Crop Safety

Spray Timing
Chart

PESTS	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
SCALE												
Soft Brown/Black Scale M		M	M	D	D	D	M	D	D	M	M	M
Olive Scale..... M		M	M	D	D	D	M	D	D	D	D	M
California Red Scale... M		M	M	M	M	D	D	D	D	D	M	M
Oleander Scale..... M		M	M	D	D	D	M	D	D	M	M	M
BUGS												
Olive lace Bug. M		M	D	D	D	D	D	D	D	D	M	M
MITES												
Mites. -		-	M	D	D	D	M	M	D	D	D	-
DISEASES												
Peacock Spot. -		D	D	M	M	-	-	M	D	D	D	M
OTHER												
Snails / Slugs. -		-	D	D	M	-	-	M	D	D	-	-
Ants. M		M	M	D	D	D	D	D	D	D	M	D

Timings Will Vary

This chart provides a suggested approach to IPM program timings.

The timings of insect activity noted here are a guide only, as activity can vary with different seasons.

In general activity commences earlier the further north the planting. Hence regular monitoring of groves is essential.

M - Pest **Monitoring** Period
D - Pest **Activity/Damage** Period
 - Best Time For Spraying