GROCHEM AUSTRALIA

DISEASE AND INSECT MANAGEMENT STRATEGY FOR NUT CROPS GROWN IN AUSTRALIA

australia grochem

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INTRODUCTION

The purpose of this document is twofold:

- To provide an explanation as to the workings of Protectant Fungicides which are integral to disease management and how best to get optimal fungicidal value from the range available to growers.
- To introduce Grochem Peregrine Insecticide, which is soft on most beneficial insects including bees and therefore ideal for any IPM programme.

Grochem supports the Tree Nut industry and is a traditional sponsor to National Conferences, including Almond & Macadamia and TriNut Conference. Technical support is available to individual organisations.

Considerable R&D resource have been allocated to the development of new products as well as label extensions in order to provide a complete Pest and Disease Management Solution.

Tree crops can be divided into EVERGREEN and DECIDUOUS types and each of these will be treated differently.

- Evergreen – Macadamia
- Deciduous – Almond, Walnut, Hazelnut, Pecan, Chestnut,Pistachio etc.

NOTE: This reference is a generalised recommendation. Approvals do vary from product to product and with crop types. For specific recommendation, please refer to the product label.

CONTENTS

PROTECTANT FUNGICIDES: HOW DO THEY WORK?

All Protectant Fungicides rely on excellent coverage and tenacity in order to optimise fungicidal value.
Particle size (in microns) is a key feature which determines coverage, ultimately determining effectiveness and fungicidal value.

COVERAGE

Number of Particles per gram of Product

6 MICRON
14 x 10^8 particles

4 MICRON
50 x 10^8 particles

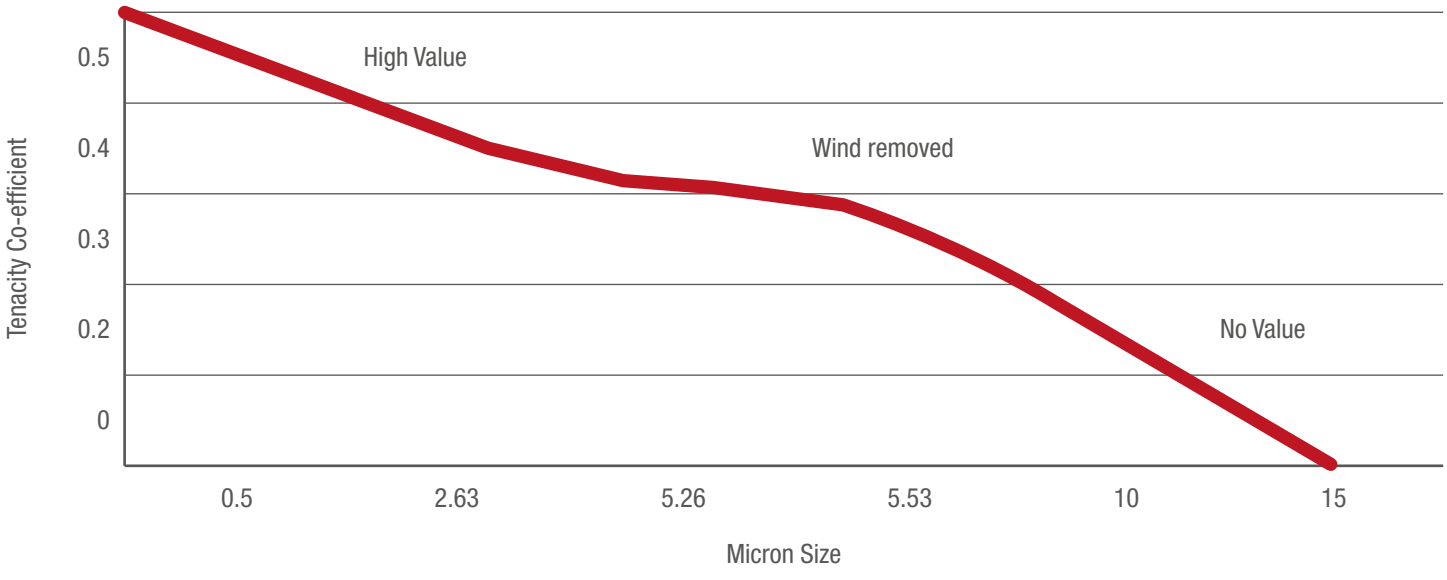
1 MICRON
4000 x 10^8 particles

TENACITY – THE ABILITY TO STICK TO THE PLANT LEAF & TISSUE SURFACE

Protectant Fungicides must remain on the plant in order to perform a fungicidal / bacterial function.
Any particles that fall off the protected plant surface will no longer provide protection.

The smaller the particle the greater the ability to stick, and this slide illustrates the effect particle sizing has on tenacity ranging from 0.5 micron (highest adhesion) to 10 – 15 micron (lowest).

Any particle 10 micron and above has no value at all.



RAIN

Rain removes deposits considerably faster than wind, but wind is more prolonged than rain.

- 40% removal after the first 6mm of rain
- 4% removal after the next 6mm of rain
- 1 – 2% removal after the next 6mm of rain

WIND

Wind alone will reduce deposits by 50% after 27 days.
Reference: Summers & Thomas

The addition of a non-ionic surfactant reduces water tension.
Spread and tenacity is improved considerably. Refer section on adjuvants.

The above statistics are a generalisation. Every formulation behaves differently.

MODE OF ACTION & LENGTH OF CONTROL

Protectant Fungicides must be applied onto the plant surface – BEFORE – any infection.

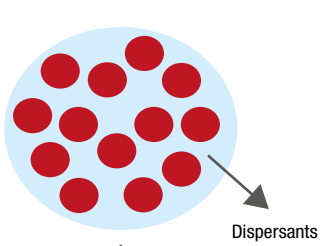
Copper formulations degrade in acidic solutions and are unstable in highly alkaline solutions.
It is therefore essential that the spray solution is maintained at the 6.8 – 7.4 pH range.

On contact with water the wettable granule will disperse and revert to its powder form which then "sticks" to plant surfaces.

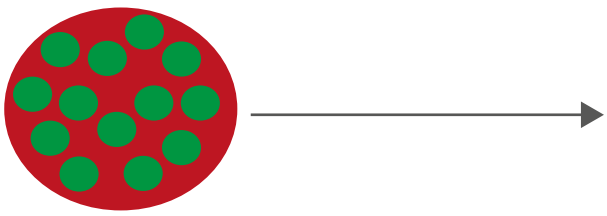
THE STARTING POINT

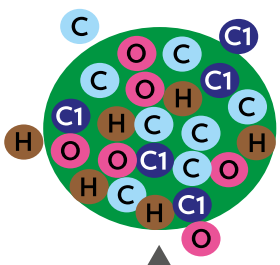
Granule:
Compressed individual power particles.

Which disperse on coming into contact with water.



Power Particle:
Comprising molecules of Copper Oxychloride or Copper Hydroxide.





PARTICLE DEGRADING

Molecule Disintegrating:
(Bioactive)
"Active" Copper = copper on the outside of the molecule or atoms of copper breaking free.

Molecule:
COC
COH

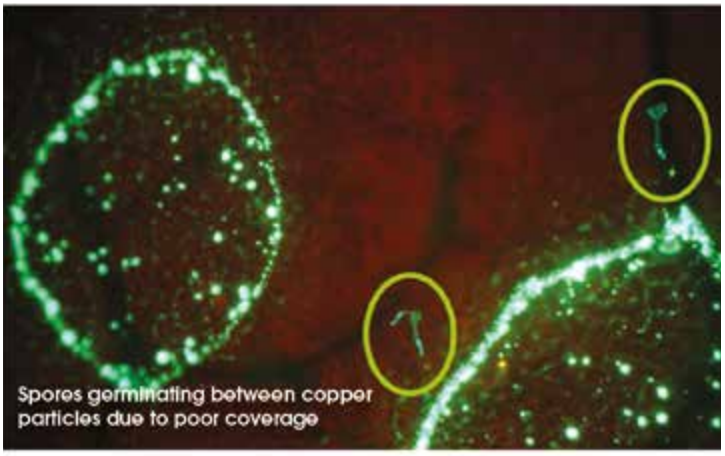
Once the spray droplets dry, the particle remains in a fixed position on the plant tissue and acts as a copper ion reservoir. Degradation of the particle and the release of the copper ion requires moisture, which is a combination of water and weak organic acids that exist on the plant leaf surface.

For this reason, we suggest using the more soluble forms such as Hydrocop WG, Grochem Bordeaux WG or Grochem Tribasic Liquid in the dryer conditions and the less soluble forms such as Coppox WG in moist conditions.

The steady release of copper ions occurs over a period of several weeks and the rate of release depends on the formulation type, the particle size and the moisture conditions.

The particle will deteriorate under certain conditions

- The actual particle releasing ions
- Rain
- Wind
- Leaf abrasion
- Expansion of leaf / fruit.



RUN-OFF
Botrytis spores' germination despite an application of fungicide.

SOLUBILITY & THE RATE OF COPPER ION RELEASE

At a pH of 7, these products are virtually insoluble in water.

As the pH of the water decreases the solubility of the copper particle increases, leading to an increase in the release of copper ions – and hence the caution of using acidic based foliar fertilisers. Too fast a copper ion release will lead to crop effect.

Assuming the same particle sizing, Coppox WG/WP would be the least soluble formulation and therefore the longest acting – whereas Grochem Tribasic Liquid would be the most active form, but least residual.

COPPER PRODUCTS - SOLUBILITY IN WATER			
MORE SOLUBLE ↓	Copper Oxychloride	< 10-5 mg/L	(Coppox WG/WP)
	Cuprous Oxide	0.64 mg/L	(Grochem Red Copper WG)
	Copper Hydroxide	2.9 mg/L	(Hydrocop WG)
	Tri Basic Copper Sulphate	3.42 mg/L	(Grochem Bordeaux WG) (Grochem Tribasic Liquid)
			↑ LONGER LASTING

GROCHEM COPPER-BASED FUNGICIDE RANGE

All Copper-based Products are produced using very high grades of copper as the raw material and, as a result, undesirable heavy metals are extremely low to non-existent.

Both Grochem Hydrocop WG and Grochem Bordeaux WG are Certified through NASAA for Organic Input and this again demonstrates the quality of the products.

NASAA® INPUT FOR ORGANIC PRODUCTION

ENVIRONMENTAL IMPACT

Consideration is given during manufacturing to ensure minimal impact on the environment. This includes waste water disposal and air pollution.

All products are manufactured to ISO 9001:2008 Standards.

All formulations, with the exception of Coppox WP and Grochem Tribasic Liquid, are wettable granules, which substantially reduce the OH&S risk to the operator.

The production time of a WG formulation is approximately two and a half times that of a WP formulation. Consequently the production output is reduced, which then impacts on the cost.

Despite this, we feel OH&S is far more important than the additional or lost production volumes.

Mammalian Toxicity = low

Honey Bee Toxicity = low

WHICH COPPER FORMULATION TO USE?

There are numerous brands and formulation types available to growers, hence the dilemma.
When making this choice consider seasonal conditions and growth stage.

The overriding suggestion would be to "…stick to known and recognised brands…"

CONSIDERATIONS:

1. SEASONAL CONDITIONS:

- If dry, use the more "soluble" of the four types, i.e. Hydrocop WG or Grochem Bordeaux WG or Grochem Tribasic Liquid.
- If wet – and that includes heavy dew on a daily basis, rain showers, mist, etc. – use the less soluble forms: i.e. Coppox WG/WP or Grochem Red Copper WG.
  Note: The more soluble forms perform in any conditions.

Any formulation can be used, however the less soluable forms will provide greater value.
Coppox, for example, provides 100gm active copper vs Red Copper at 77gms.

Refer Comparative Table of copper decreasing with increased solubility.

Product	Rate per 100 Litres of Water	
	Label Rate g/mL	Active Copper
Coppox WG/WP	200	100.0
Grochem Red Copper WG	155	77.5
GrochemBordeaux WG	280	56.0
Hydrocop WG	105	52.5
Grochem Tribasic Liquid	280	53.2

2. GROWTH STAGE

Plant tissue is most vulnerable to infection when tissue has been damaged.

The presence of moisture and nutrients in the exposed, damaged part are an ideal media for pathogen infection.

Consequently the most critical application times should be just prior to or during all stages where damaged tissue is exposed:

EVERGREEN

- Pre-flowering: Grochem Bordeaux WG
- Early flowering: Peregrine Insecticide
- Peak flowering: Hydrocop WG
- Nut set: Hydrocop WG
- Pea size and spring flush: Peregrine Insecticide
- Shell hardening and oil accumulation: Coppox WG

DECIDUOUS

- **Leaf Fall:** Hydrocop WG or Coppox WG
- **Bud swell/cracking:** Grochem Bordeaux WG (very long lasting)
- **Post Petal Fall:** Hydrocop WG
- **Throughout the growing season:** Hydrocop WG

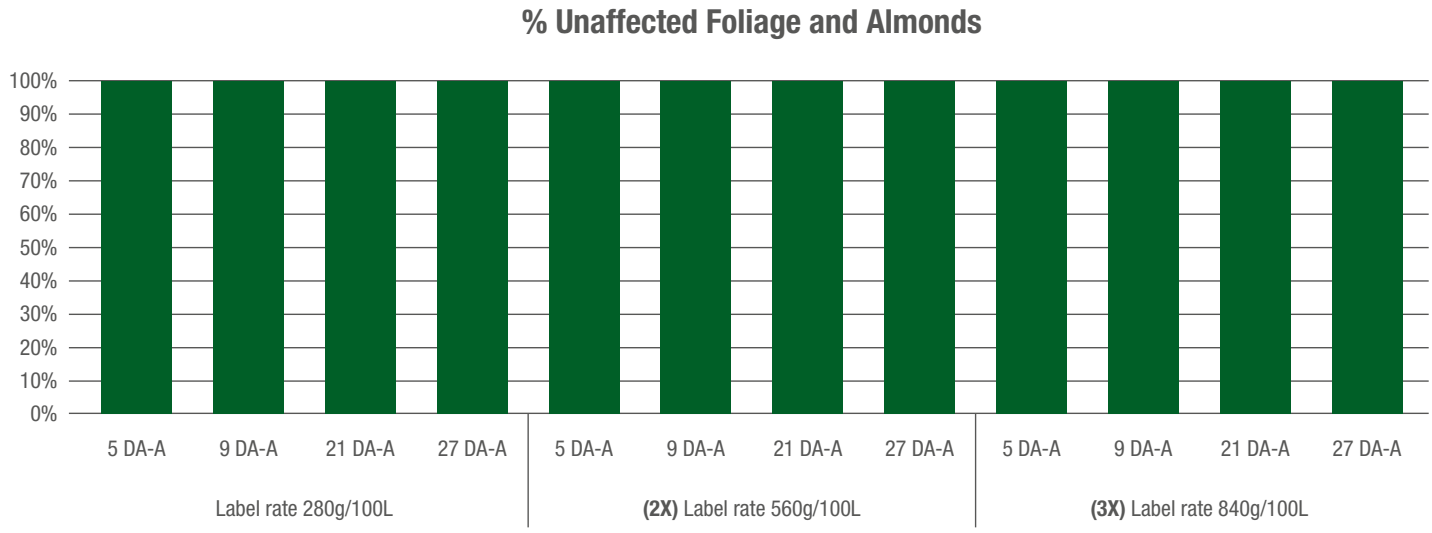
The different formulations can be used at any of the above stages, however these are the preferred formulations given each set of circumstances.

The different formulations have their strengths and weaknesses and in summary there is no single “silver bullet”. Thought should be given to selecting the most effective option given your particular circumstances.

Extensive trials programs are designed to develop correct label rates and timings, in relation to crop safety and product efficiacy.

The trial results below have been performed with Copper ONLY and the addition of other products or foliar fertilisers could alter the results and cause phytotoxicity.

Almond Crop Safety Graph
Grochem Bordeaux 200g/kg Tri-basic copper sulphate
There was not foliage or almond crop phytotoxicity at label rate, 2 times label rate and 3 times label rate
Trial Location: Kialla, Victoria, Australia 2017/2018



Assessments made
5 DA-A 5 Days after application
9 DA-A 9 Days after application
21 DA-A 21 Days after application
27 DA-A 27 Days after application

OTHER PRODUCTS USED IN NUT CROPS

FUNGICIDES

- **GROCHEM CAPTAN 800 WG – 800g/kg Captan**
- **FORTUNA GLOBE 750 WG – 750g/kg Mancozeb**
- **KINGFISHER SYSTEMIC FUNGICIDE – 250g/L Difenoconazole**
- **CROP DOC 600 – 600g/L Phosphorous (Phosphonic) Acid**

Note: Approval rates do vary – refer to the product label.

GROCHEM CAPTAN 800 WG – 800g/kg Captan

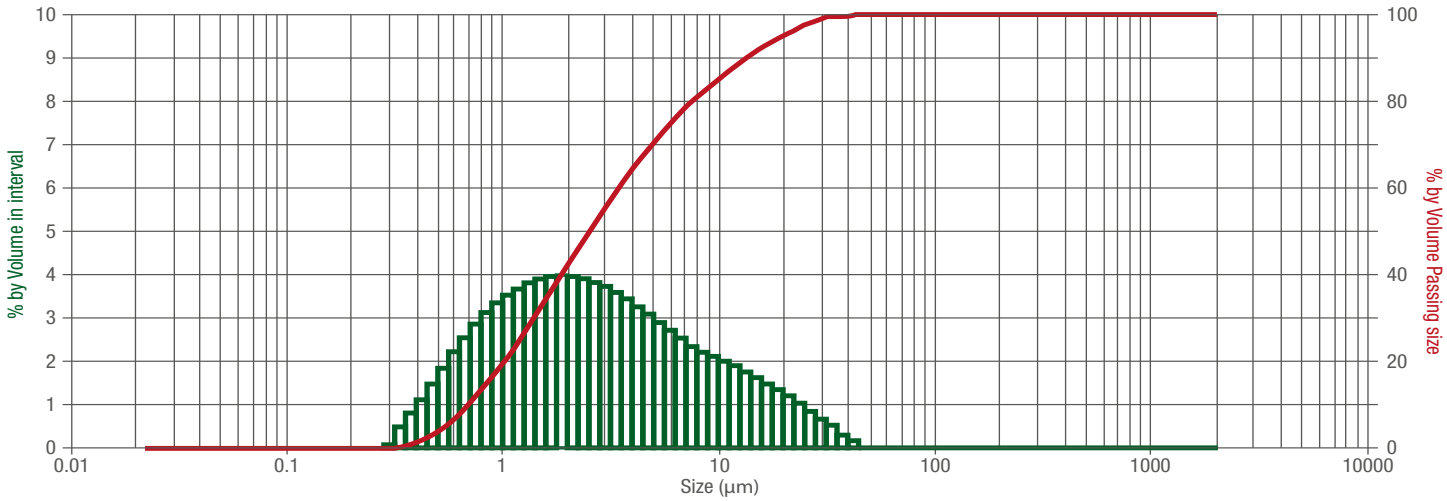
Grochem Captan 800 WG is Approved for use on Almonds and several other crops.

MODE OF ACTION

Grochem Captan 800WG is a protectant fungicide with some curative properties and no adverse effect on Bees.

Being predominantly a protective fungicide, coverage is critical, hence the need for an ultra-fine particle sizing (at 2.1 micron).

Low solubility: 3.3mg/l in water, which is similar to the solubility of Grochem Bordeaux, and for that reason similar considerations apply.



Label Rate for Grochem Captan 800 WG

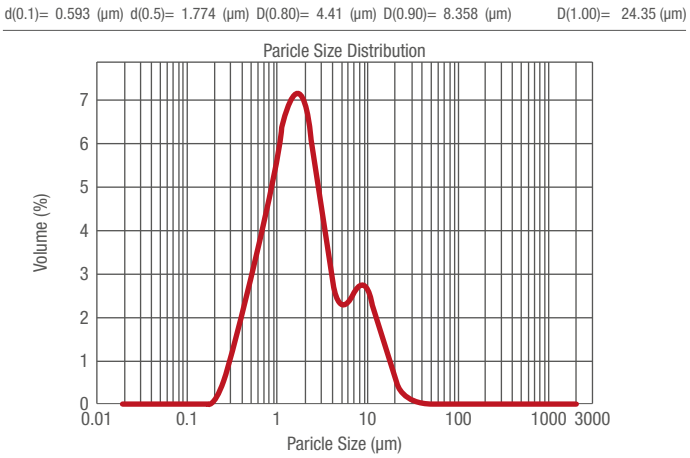
RATE				CRITICAL COMMENTS
In the following table, all rates are given for dilute spraying. For concentrate spraying, refer to the Mixing/Application section.				For all uses in this table apply by dilute or concentrate spraying equipment. Apply the same total amount of product to the target crop whether applying this product by dilute or concentrate spraying methods. DO NOT use at concentrate rates greater than 250g/100L water.
CROP	**DISEASE**	**STATE**	**RATE/100L**	
Almonds	Anthracnose (*Colletotrichum acutatum*) Blossom blight (*Monolinia laxa*) Shot hole (*Wilsonomyces carpophilum*)	NSW, Vic & SA only	**Dilute spraying** 200 g/100 L (maximum spray volume 2000L/ha) **Concentrate spraying** Refer to the Mixing/ Application section	Apply a total of 3 applications commencing at petal fall followed by applications at 2-3 week and 4-5 week intervals after the start of petal fall. Use the shorter intervals under higher disease pressure. Grochem Captan 800 WG Fungicide should be used as part of an integrated control program, using applications of other approved fungicides. DO NOT APPLY AFTER THE END OF PETAL FALL. DO NOT GRAZE ANY TREATED AREA OR CUT FOR STOCK FOOD.

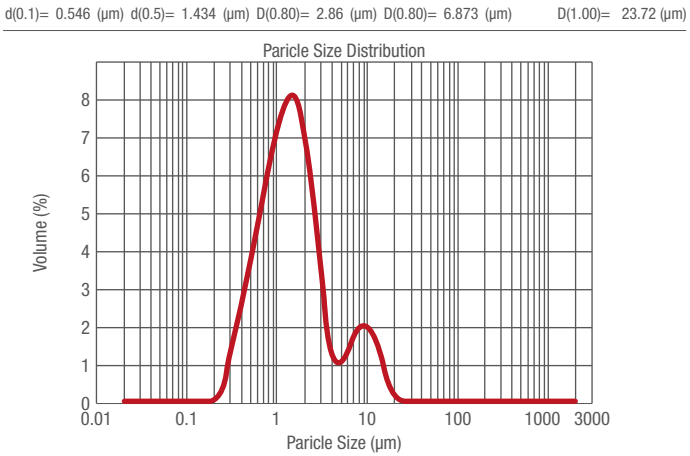
FORTUNA GLOBE 750 WG

FORTUNA GLOBE 750 WG – 750g/kg Mancozeb

Mancozeb, like the copper formulations is a Protectant Fungicide and for this reason it will follow the same principles as explained in the copper formulations.

Mancozeb is also widely used on a number of different crops, including almond crops.





MANUFACTURE & ENVIRONMENTAL IMPACT

- Fortuna Globe 750 WG is manufactured to European Standards using European ingredients:
  - > Manufacturing Site - Accreditation Standards:
    - ISO 9001: 2008
    - ISO 14001: 2004
    - ISO 18001: 2007
  - > Satisfies the EU requirement for waste water disposal
- The impurity: Ethylenethiourea (ETU) is exceptionally low at maximum 0.055%.
- Bee toxicity: Very low: 208 – 400mµ per bee.
- Breaks down rapidly in the soil and has little to no effect on earth worms.
- Contains both manganese (15%) and zinc (1.5%) and has an ultra-low solubility in water.

RAIN-FAST

Mancozeb formulations are traditionally extremely unstable on plant tissue*. Steps have therefore been taken in the Fortuna Globe 750WG Formulation to significantly improve rain-fastness resulting in a tenacious product.

* Reference: Rain Fastness and Persistence of Fungicides for Control of Alternaria Brown Spot of Citrus – by A. Vicent, *et al*

DISEASE CONTROL

Fortuna Globe 750 WG controls a very wide range of diseases in a large number of crops, including almonds.

When copper + Fortuna Globe 750 WG + Grochem Captan 800 WG are mixed, all diseases would be covered.

BOTRYOSPHAERIA CANKER (ALSO KNOWN AS BOT CANKER)

A series of both protectant and systemic fungicides were trialled against this pathogen.
Mancozeb was confirmed as the more effective protectant fungicide on this organism.

Refer article: Evaluation of Fungicides for the management of *Botryosphaeria* die back diseases of grape vines – by Nicolas T Anponsah *et al*.

KINGFISHER SYSTEMIC FUNGICIDE – 250g/L Difenoconazole

Kingfisher is systemic fungicide with preventative and curative actions. The active ingredient is absorbed the by the leaves with both ACROPETAL and TRANSLAMINER translocation.

The translocation provides long lasting activity against a wide range of fungal diseases over a wide range of crops.

This product is considered non-toxic to bees and does not accumulate in the Mammalian body and is very low toxicity to birds.

Label Rate for Kingfisher Systemic Fungicide - 250g/L Difenoconazole

CROP	DISEASE CONTROLLED	STATE	RATE/HA	WHP	CRITICAL COMMENTS
Macadamia nuts	Husk Spot (*Pseudocercospora macadamiae*)	All States	**Dilute spraying** 50 mL/100 L water **Concentrate spraying** Refer to the Application section	-	Apply by dilute or concentrate spraying equipment. Apply the same amount of product to the target crop whether applying this product by dilute or concentrate spraying methods. Use in a protectant fungicide program containing fungicides from different chemical groups. Commence fungicide applications at nut set (approximately late September) and continue the fungicide program until late December, with applications at 3 to 4 week intervals. Apply a maximum of 2 applications of KINGFISHER per season. Ensure thorough spray coverage. Add an appropriate Spray Activator/Spreading agent (600g/l) at a rate of 10 mL/100 L.

CROP DOC 600

CROP DOC 600 – 600g/L Phosphorous (Phosphonic) Acid

A Systemic Fungicide for the suppression of phytophthora in almonds and control of phytophthora and trunk canker in macadamia trees.

GROCHEM CROP DOC 600 is a specially formulated 600 g/L of Phosphorous (Phosphonic) Acid present as Mono (and) Di Potassium Phosphite. As a result of this formulation it is a nearly neutral pH product, which aids in plant uptake, movement and disease control. A near neutral pH will also help with product compatibility, when mixing with product such as coppers.

CAUTION: Check spray pH mix before application.

GROCHEM CROP DOC 600 is rapidly transported from the point of entry throughout the plant to the site of infection. This is especially important when dealing with root and tissue acting diseases. The mode of action combines both toxicity to the infection as well as aiding natural plant defenses.

GROCHEM CROP DOC 600 is short lived in the plant, it oxidises to Phosphate , which is a high demand macro-nutrient required for plant growth. This rapid breakdown to plant available nutrients gives it a short withholding period.

GROCHEM CROP DOC 600 can used in Almonds and Macadamias as per APVMA conditions.

Always read the permit before using. For the most up to date permits go: portal.apvma.gov.au/permits.

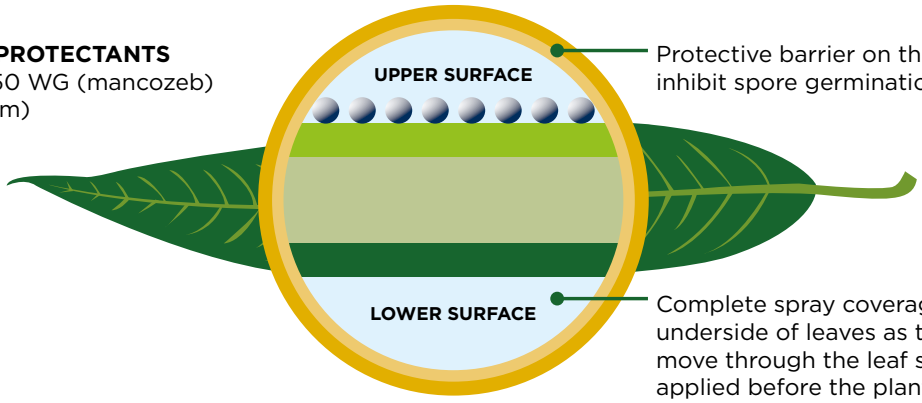
Permit No.	Description	Status	Issued date	Expiry date
PER13199	Phos acid / Almonds / Phytopthora	CURRENT	12 December, 2011	3 Mar, 2020
PER84766	To control Phytophthora/ trunk (stem) canker Macadamia trees	CURRENT	30 ,November, 2017	30 November, 2020

SUMMARY OF EFFECTIVE FUNGICIDES ON VARIOUS DISEASES ACROSS ALL CROPS REGISTERD IN:

Product	Rust	Hull Rot		Leaf Curl	Shot-hole	Bacteria (Z)	Anthracnose	Phytophthora
		Rhiz	Mon					
Bordeaux WG	✔✔			✔✔✔	✔✔✔	✔✔✔	✔✔	
Tribasic Liquid SC	✔✔			✔✔✔	✔✔✔	✔✔✔	✔✔	
Hydrocop WG	✔✔			✔✔✔	✔✔✔	✔✔✔	✔✔	
Coppox WG	✔✔			✔✔✔	✔✔✔	✔✔✔	✔✔	
Captan 800 WG			✔✔✔		✔✔		✔✔✔	
Fortuna Globe 750 WG	✔✔		✔✔✔		✔✔		✔✔	
Crop Doc 600								✔✔

FUNGICIDE PERFORMANCE – THE EFFECT OF SYSTEMICITY

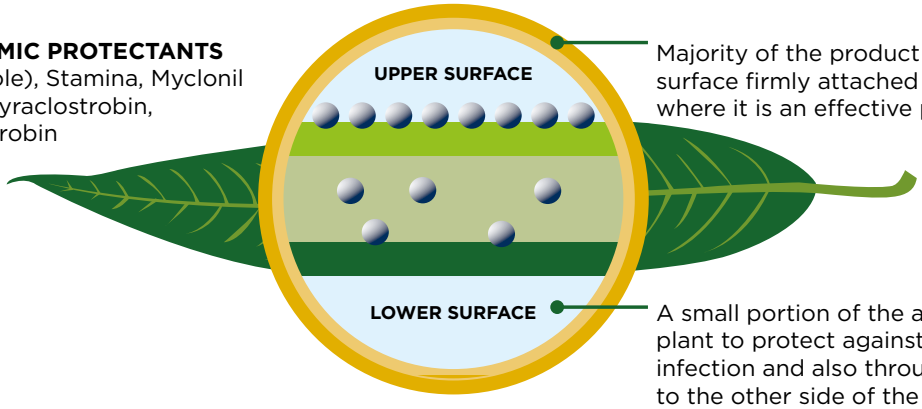
NON SYSTEMIC PROTECTANTS
Fortuna Globe 750 WG (mancozeb)
Fruitcote (metiram)
Bordeaux WG,
Coppox WG,
Hydrocop WG,
Tribasic Liquid
(Coppers)



Protective barrier on the plant surface inhibit spore germination and survive.

Complete spray coverage is essential for underside of leaves as the product does not move through the leaf surface. Must be applied before the plant tissue is infected.

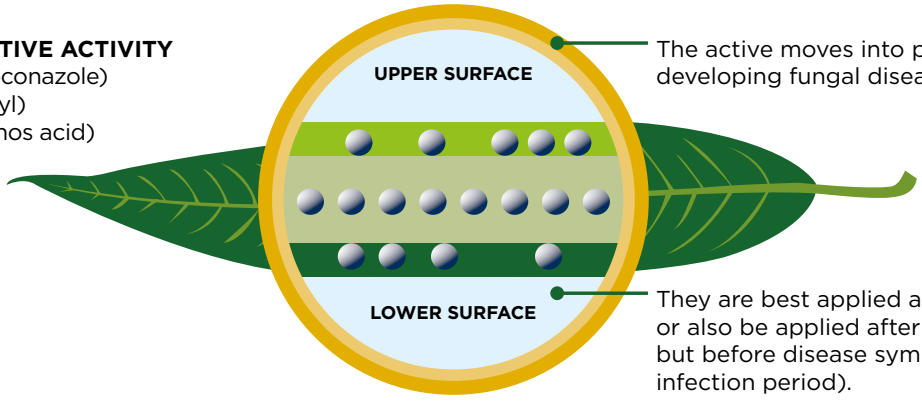
LOCALLY SYSTEMIC PROTECTANTS
Pearl (penconazole), Stamina, Myclonil (myclobutanil), pyraclostrobin, boscalid, azoxystrobin



Majority of the product remains on the plant surface firmly attached to the waxy cuticle where it is an effective protectant.

A small portion of the active moves into the plant to protect against the very early stages of infection and also through translaminar activity to the other side of the leaf.

SYSTEMIC CURATIVE ACTIVITY
Kingfisher (difenoconazole)
Metman (metalaxyl)
Crop Doc 600 (phos acid)



The active moves into plant tissue to control the developing fungal disease.

They are best applied as a protectant application, or also be applied after infection has occured but before disease symptoms appear (the latent infection period).

They are generally less effective for protectant activity as the active is metabolised by the plant and less product remaining on the outer plant surface.

PEREGRINE

INSECTICIDES

PEREGRINE 240g/L Methoxyfenozide

Peregrine is a group 18 insecticide, the active Methoxyfenozide belongs to the diacylhydrazine class of insecticides and has a novel mode of action. The chemical mimics the action of the Page 2 molting hormone of Lepidopterous (moths, butterflies) larvae.

Peregrine Insecticide is non-systemic, that once applied has residual activity for up to 21 days.

Methoxyfenozide is considered soft on non-target organisms, including a wide range of non-target and beneficial insects, which makes it ideal for IPM programs.

Peregrine Insecticide is registered in Almonds for the control of Carob Moth and Macadamia nuts for the control of Macadamia nutborer and Flower Caterpillar.

In Almonds Peregrine should be used in a program targeting both 1st generation (Early post flowering, Aug-Sept) and 2nd generation (Hull split).

When using Peregrine to control Carob Moth in Almonds, larvae (caterpillars) may not appear to die for 3-6 day following the application, during this time they will not feed. Carob Moth eggs will be controlled, and new egg lays on treated surfaces do not hatch, or larvae do not survive.

In Macadamia nuts Peregrine should be used in a program targeting Macadamia flower caterpillar at egg and very small larvae growth stage, when targeting Macadamia nutborer targeted spray applications should be applied to thoroughly cover the nuts and targeting the eggs and early instar larvae growth stage.

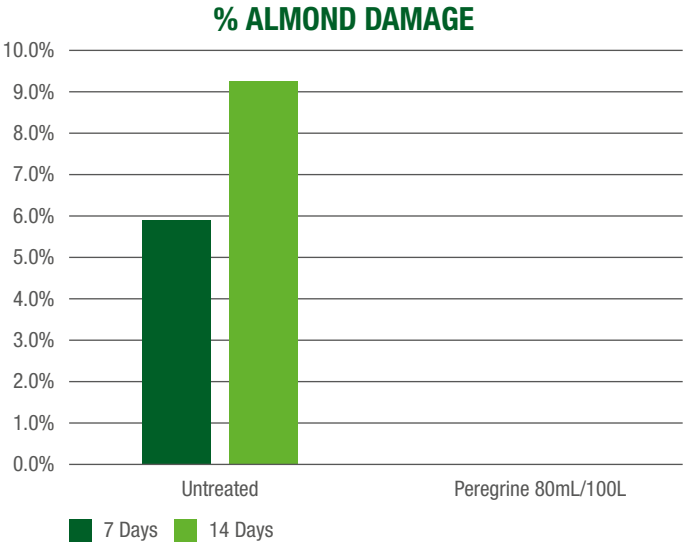
Peregrine should be applied with a wetting agent, such as Agral 600.

Label Rate for Peregrine 240g/L Methoxyfenozide

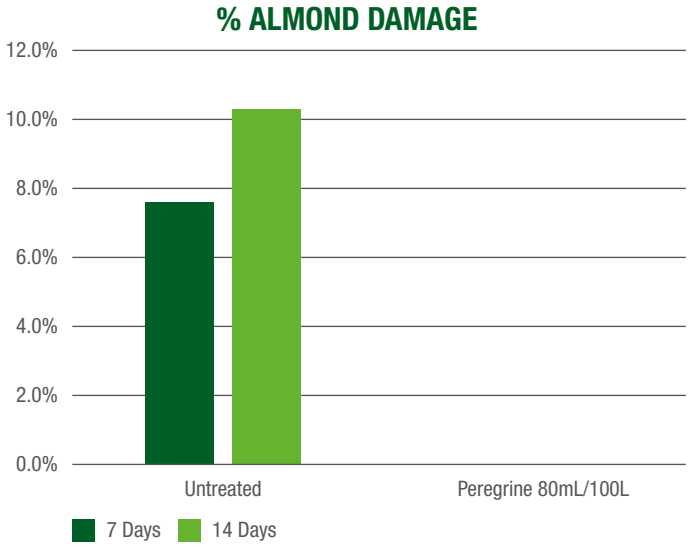
CROP	PEST	RATE/100 L	CRITICAL COMMENTS
Almonds	Carob Moth (1st generation)	80 mL + Wetter	Practice good orchard hygiene with the removal of mummified fruit in winter. Early post-flower application: At the beginning of the season (Aug-Sep), carefully monitor pheromone traps for peak adult pest incidence of 1st generation. Once regular field scouting indicates egg laying and newly hatched larvae apply a maximum of 3 sprays of Peregrine Insecticide at a minimum of 10 day intervals between sprays. Apply to complete coverage. Refer to Wetting Agents in the General Instructions section for more information.
	Carob Moth (2nd generation)		Hull-split application: Peregrine Insecticide should be applied at the start of hull split (2-5% of the almond hull sutures open). Carefully monitor pheromone traps for peak activity of 2nd generation moths. Continue field scouting for egg-laying activity, and apply Peregrine Insecticide to coincide with the initiation of egg hatch. Apply to ensure complete coverage of all foliage and fruit (hull/shell) surfaces. Concentrate spraying is not appropriate for this pest. Do not apply less than 2000 L/ha water.
Macadamia	Macadamia Flower Caterpillar	25 mL	Monitor for eggs and very small larvae on flowers and apply at a threshold of 50-80% of racemes infested.
	Macadamia Nutborer	40 mL	Spray to thoroughly cover nuts when pest numbers reach economic threshold levels according to field checks. Target sprays against eggs and early instar larvae.

PEREGRINE INSECTICIDE TRIAL RESULTS

Trial 1
Robinvale Victoria - 2016/2017
Peregrine Rate 80mL/100L
Adjuvant: Agral 600 at 0.01% of water volume
There was no phytotoxicity effect from Peregrine in the trial



Trial 2
Wood Wood, Victoria - 2016/2017
Peregrine Rate 80mL/100L
Adjuvant: Agral 600 at 0.01% of water volume
There was no phytotoxicity effect from Peregrine in the trial



Summary of effective Insecticide on various insect pests across all crops registered in.

Product	Carob Moth (eggs and larvae)	Light Brown Apple Moth	Leafroller	Macadamia Nutborer	Macadamia Flower Caterpillars
Peregrine	✔✔✔	✔✔✔	✔✔✔	✔✔✔	✔✔✔

Peregrine is a Group 18 Insecticide and therefore useful in any Resistance Management Programme.
Peregrine is non-systemic and has residual activity up to 21 days.
The active ingredient is soft on beneficial insects including bees.

Photo courtesy the Almond Board – www.australianalmonds.com.au

IMPORTANT CONSIDERATIONS

CROP SAFETY & LIQUID NUTRIENTS

Numerous efficacy and crop safety trials have been carried out over several years and at times in challenging weather conditions. Both label rates and twice label rates have been used in all crop safety trials. In every trial crop safety has been assessed and in every instance there has been ZERO crop effect at the label rates.

Water should be tested prior to the addition of the copper formulation and pH adjusted accordingly, then measured after applying the copper to double check.

Copper can be applied in conjunction with a range of liquid nutrients however, be cautious with the acidic based foliar nutrients such as Ligno-Sulfonates, Sulphates, etc.

(Refer Tech Note: Copper Formulations and Foliar Fertilisers (August 2015)).

ADJUVANTS – INCLUDING WETTERS

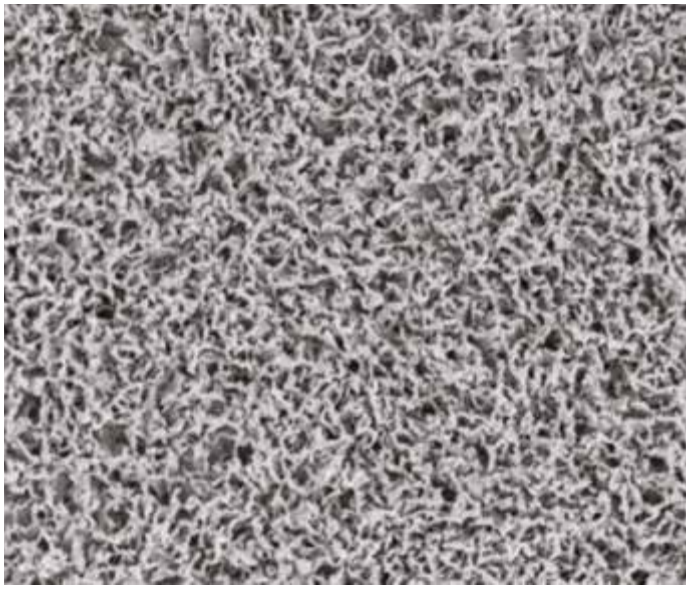
The ingredients in any WG Formulation total 100%. The major portion in the formulation is the copper in one form or the other.

Example: Coppox WG: 860gm of copper oxychloride of which 50% is copper.

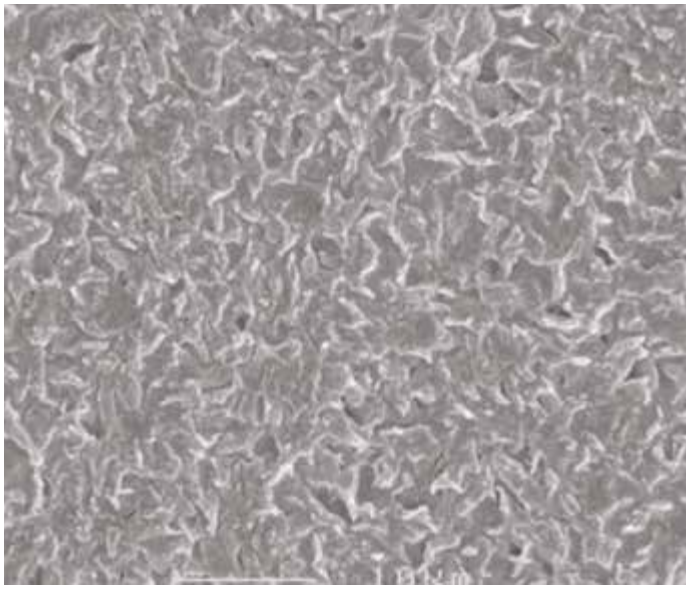
There is therefore insufficient "space" in the formulation to add sufficient surfactant to lower the surface tension of the spray droplet.

Consequently, the additional of a "soft" nonaggressive, non-ionic wetting agent such as viti-wet is essential to maintaining crop safety and improve covereage.

An incorrect choice of a wetting agent will result in damaging the all important plant cuticle and this will result in points of entry for pathogens.



Intact Plant Cuticle



Damaged Cuticle allowing pathogen points of entry

FUNGICIDE AND INSECTICIDE APPLICATION TIMES:

DECIDUOUS NUT TREES

The critical timing for any application of a protectant fungicide is whenever a "wound" appears on the plant, such as:

- Leaf fall
- Petal fall
- Buds cracking
- Pruning etc

Damaged tissue contains the ideal medium of moisture / nutrients for pathogens and infection will occur rapidly if such an ideal environment is present.

Copper-based formulations can be added to a number of different products in the spraying programme, therefore saving application costs. Refer to respective labels for compatibilities.

WINTER APPLICATION – DEDCIDOUS TREES

This is the only growth stage whereby the trunk / twigs are fully exposed and spray mix is able to cover the entire tree – filling the cracks / crevices. This will result in excellent protection for an extended period, and destroying the carry over spores in winter reduces disease pressure in spring.

Any of the coppers can be used at this stage but our suggestion would be for Grochem Bordeaux WG due to its long lasting capability and its compatibility with oils.

(Refer Tech Note: The Use Of Wetters With Grochem Copper-Based Fungicides).

Higher than usual water rates should be used, in conjunction with compatible oils and wetter.

Applied to past runoff in order to fill the cracks and crevices in the bark.

Suggested water rates: 3000 Litres per Hectare

GROCHEM BORDEAUX WG + OIL + WETTER

BUD SWELL/BUD CRACKING

Tree movement in spring coincides with spores coming out of their dormant phase. This is a strategic, essential application time.

At this growth stage we recommend Grochem Bordeaux WG.

Photo courtesy the Almond Board – www.australianalmonds.com.au

EARLY POST-FLOWERING

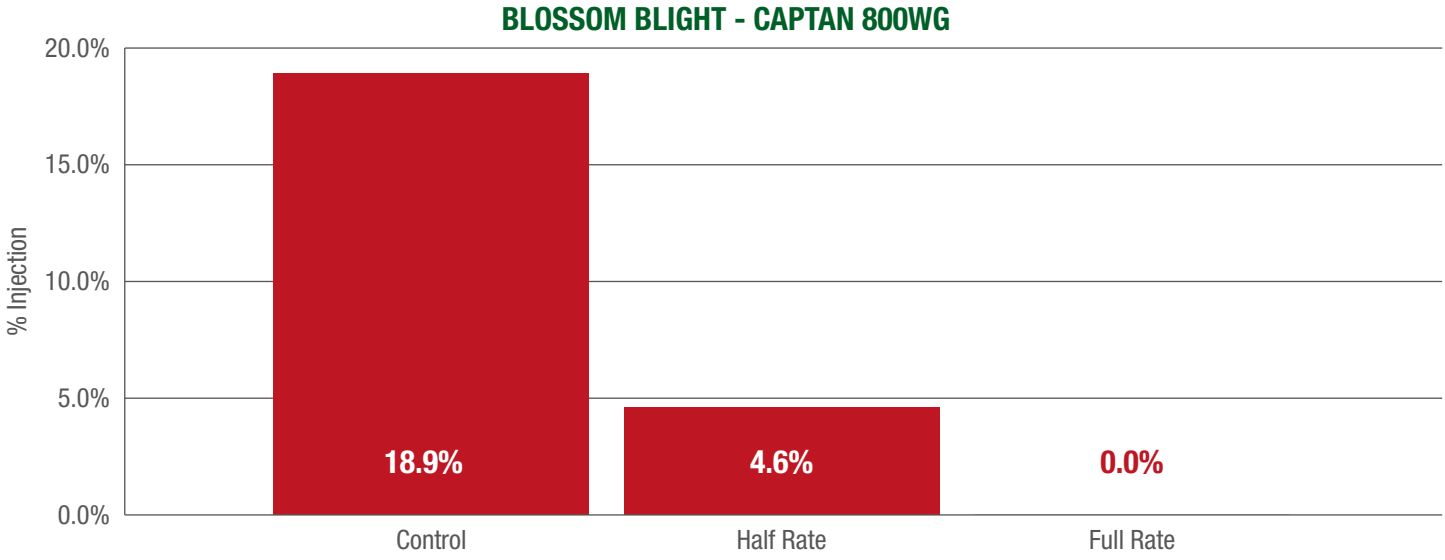
Following good orchard management practises over the winter, Carob moth (1st generation) numbers should be monitored, once regular field scouting indicates egg laying and newly hatched larvae. Peregrine insecticide should be applied.

POST PETAL FALL AND THROUGH GROWING SEASON

Hydrocop WG is registered to be applied at the commence post-flowering applications 5-7 days after petal fall is complete, and apply at 10-14 day intervals as the season dictates, to a maximum of 4 applications.

Top up applications should be applied within 21 days in order to maintain effectiveness. Frequent top-ups in conjunction with fungicides (Grochem Captan 800WG and Fortuna Globe 750WG) are far more effective than in frequent applications.

To optimise fungicidal activity, full label rates must be used. Using less than the label rate will compromise effectiveness. An average of 4 trials on Monilinia were conducted and in each case varying rates were used, and it clearly demonstrated that by using less than the label rate, resulted in less effectiveness of the product.



HULL SPLIT

Carob moth (2nd generation) numbers should be monitored carefully, Peregrine insecticide should be applied at the start of hull split (2-5% of the alomond hull suture open). Peregrine insecticide should be applied at the initiation of the egg hatching. Do not use more than 3 spays per season of Peregrine or Group 18 insecticides.

POST HARVET APPLICATION – PRE-WINTER

There is a considerable period between the pre-harvest fungicide application and first use for the following scenarios. During this time, pathogen numbers build up and this can lead to an early infect and high disease pressure.

Stone fruit growers recognise the risk and consequently have a post-harvest “clean-up strategy”.

Copper applications are desire at:

- 25-50% leaf fall and again at 90-100%

EVERGREEN TREES - MACADAMIA

The majority of product labels will have in the Critical comments section, words to the effect:

"Ensure thorough coverage" or "Good spray penetration of foliage is essential"

Evergreen trees pose a far greater challenge than their delicious counterparts. Apart from the foliage (which can shield limbs/twigs) they also have height and density to contend with.

Recognising these challenges there is an advantage to applying a Protectant and Systemic Fungicide at the same application time.

EXAMPLES

- Coppox WG
- Grochem Bordeaux WG
- Kingfisher Systemic Fungicide

Growth Stage and Application Timing

MONTH Note: Generalised as timing changes from district to district	GROWTH STAGE	PEST/DISEASE	PRODUCT
July	Pre-flowering	Flower caterpillar	Peregrine Insecticide
		Disease Clean-up	Grochem Bordeaux WG
August	Early flowering	Flower caterpillar	Group 1B insecticide
Sept-Oct	Peak Flowering/Nut Set	Flower caterpillar	Peregrine Insecticide
		Husk Spot	Kingfisher
		Anthracnose	Hydrocop WG
October	Nut Set	Husk Spot	Kingfisher
		Anthracnose	Hydrocop WG
November	Pea Size/ Spring Flush	Nut Borer	Peregrine Insecticide
January	Spring Flush	Husk Spot	Kingfisher
		Anthracnose	Coppox WG
Feb to May	Shell Harding	Phytophthora	Crop Doc 600*
		Pink Limb Blight	Coppox WG

*Crop Doc 600 is pH buffered, can be tank mixed with coppers.

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