caLypso®

Calypso® 480 SC Insecticide

Technical Guide

For the control of codling moth (*Cydia pomonella*), woolly apple aphid (*Eriosoma lanigerum*) and apple dimpling bug (*Campylomma liebknechti*) in pome fruit and oriental fruit moth (*Grapholita molesta*) in pome and stone fruit, including insect strains resistant to organophosphate and carbamate insecticides.

Bayer CropScience

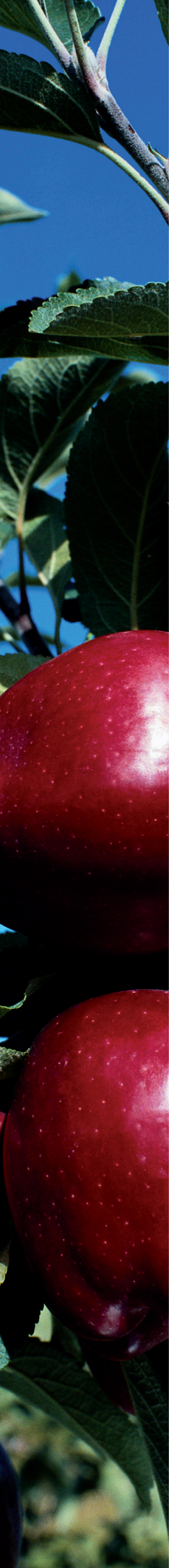
Key benefit summary

Calypso® 480 SC Insecticide from Bayer CropScience represents a significant breakthrough in the control of codling moth (CM), oriental fruit moth (OFM) and apple dimpling bug (ADB) providing topfruit growers with an effective tool for managing these serious pests. Only Calypso provides the following combination of benefits:

- Control of a range of both chewing and sucking insect pests
- Three-way activity against codling moth (young larvae, adults and freshly laid eggs)
- Activity against young OFM and CM larvae on leaf and fruit surfaces and inside shoot tips. Also activity on ADB and woolly apple aphid (WAA)
- A unique mode of action quite distinct to organophosphate (OP), synthetic pyrethroid (SP), carbamate and insect growth regulator (IGR) insecticides
- Good residual activity and acts as an acute stomach and contact poison
- A wider window of application than IGRs allowing a more flexible application timing
- A genuine 'soft' solution for the effective control of a range of pests in IPM systems

Feature	Benefit
Group 4A insecticide	Excellent resistance management tool
Relatively resistant to rainfall and sunlight	Remains on the leaf surface for longer allowing for good residual control
Systemic and translaminar activity	Controls young OFM larvae that have burrowed into shoot tips prior to a Calypso application
Contact and stomach poison	Controls CM larvae that may discard the fruit skin without ingestion*
Safety to honeybees	Can safely be applied during the flowering period (do not apply while bees are actively foraging)
Well tolerated by a range of beneficial species	Compatible with farming systems that utilise predatory mites. Also under practical field conditions overseas studies have shown that Calypso does not have an adverse effect on the level of parasitisation of WAA by *Aphelinus mali*
Selective insecticide	Does not cause 'flaring' of mites or mealybug
Good plant compatibility	Good fruit finish
Application during flowering	Controls ADB during the flowering period

*The contact activity of Calypso allows it to control codling moth larvae that may discard the fruit skin without ingestion, and would otherwise escape the effects of insecticides that work best as stomach poisons.



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Exclusion of liability

The information and recommendations set out in this brochure are based on tests and data believed to be reliable at the time of publication. Results may vary, as the use and application of the products is beyond our control and may be subject to climatic, geographical or biological variables, and/or developed resistance. Any product referred to in this brochure must be used strictly as directed, and in accordance with all instructions appearing on the label for that product and in other applicable reference material. So far as it is lawfully able to do so, Bayer CropScience Pty Ltd accepts no liability or responsibility for loss or damage arising from failure to follow such directions and instructions.

Introduction

Our technical guides are designed to provide technical information to key advisors within the horticulture industry. Experience has shown that the information contained within the guide must not just recognise the product attributes in isolation but how they impact and integrate into farming practice. It is this principle that will ensure that these technical guides remain a valuable information source.

Calypso 480 SC is a unique chloronicotinyl insecticide (CNI) which provides excellent control of codling moth, oriental fruit moth and apple dimpling bug when used as directed.

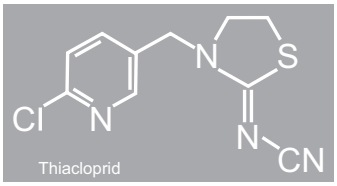
It contains the unique active ingredient thiacloprid, which is distinguished from other lepidopteran insecticides used in orchard fruit production by its excellent systemic and broad-spectrum activity – controlling a range of both chewing and sucking insect pests, its relative safety to honeybees, and a unique mode of action that is quite distinct to OPs, SPs, carbamates and the IGRs. Consequently, Calypso is an excellent tool for insecticide resistance management strategies.

Calypso is well tolerated by a range of beneficial species and is much softer on some beneficial species than conventional insecticides used in orchards for the control of certain lepidopteran pests. Calypso is compatible with farming systems that utilise predatory mites as part of a pest management strategy. Overseas studies have shown that it does not disrupt parasitism of woolly apple aphid by *Aphelinus mali* and further studies have confirmed the relative safety of Calypso to honeybees. Therefore it is one of the few insecticides that can safely be applied during the flowering period, providing greater flexibility in spray timing. In line with good agricultural practice, application of Calypso should be avoided when bees are actively foraging.

Calypso provides excellent crop safety and once spray deposits have dried, is relatively resistant to rainfall and sunlight, thus remaining on the leaf surface longer to enable maximum penetration of the active ingredient into the plant.

Product formulation

The active constituent

Common name:	thiacloprid
Chemical name (CAS):	3-[(6-chloro-3-pyridinyl) methyl]-2-thiazolidinylidene]-cyanamide
Chemical class:	chloronicotinyl (CNI) chemical family or, neonicotinoids
Molecular formula:	$C_{10}H_9ClN_4S$
Structural formula:	

Thiacloprid

Molecular weight:	252.8 g/mol
Appearance:	yellowish crystalline powder
Odour:	no characteristic odour
Melting point:	136°C
Solubility in water:	0.185 g/L at 20°C (not influenced by a pH value of between pH 4 and pH 9)
Solubility at 20°C in organic solvents:	in acetone 64 g/L, in 2-propanol 3.0 g/L
Vapour pressure:	3 x 10^{-12} hPa at 20°C
Partition co-efficient:	log P_{OW} at 20°C: 1.26 (low risk of bioaccumulation)

The product

Tradename:	Calypso
Formulation:	suspension concentrate (SC)
Active ingredient content:	480 g/L thiacloprid
Appearance:	light brown liquid suspension
Odour:	weak characteristic
Storage stability:	at least 2 years when stored according to label directions
Flammability:	not flammable
Chemical properties:	not corrosive, not explosive
Poison schedule:	schedule 6
Dangerous goods classification:	"Dangerous good" for transport by road or rail according to the Australian Code for the Transport of Dangerous Goods by Road and Rail: PESTICIDE, LIQUID, TOXIC, N.O.S. (contains thiacloprid) Class 6.1, Packing Group III, UN 2902. Marine Pollutant.

Toxicological properties of thiacloprid

Thiacloprid possesses a moderate acute oral and inhalation toxicity and is considered of low toxicity if acutely exposed via the dermal route. It is not irritating to the skin, but is a slight eye irritant (note: thiacloprid in formulation as Calypso 480 SC is not considered an eye irritant). Following evaluation of a range of short and long term toxicological studies it has been concluded that there should be no adverse effects on human health from the use of Calypso when used in accordance with label directions.

TABLE 1

Toxicological properties of thiacloprid

Parameter	Species	Result
Acute oral LD_{50}	rat	836 mg/kg body weight (males) 444 mg/kg body weight (females)
Acute dermal LD_{50}	rat	> 2000 mg/kg body weight
Acute inhalation LC_{50}	rat	> 2535 mg/m^3 air (males) 1223 mg/m^3 air (females)
Irritant action, skin	rabbit	Non-irritant
Irritant action, eye	rabbit	Slight irritant[1]
Sensitisation	guinea pig	Non-sensitising

[1] Calypso 480 SC Insecticide as a formulated product is not considered an eye irritant.

Biological properties

Mode of action

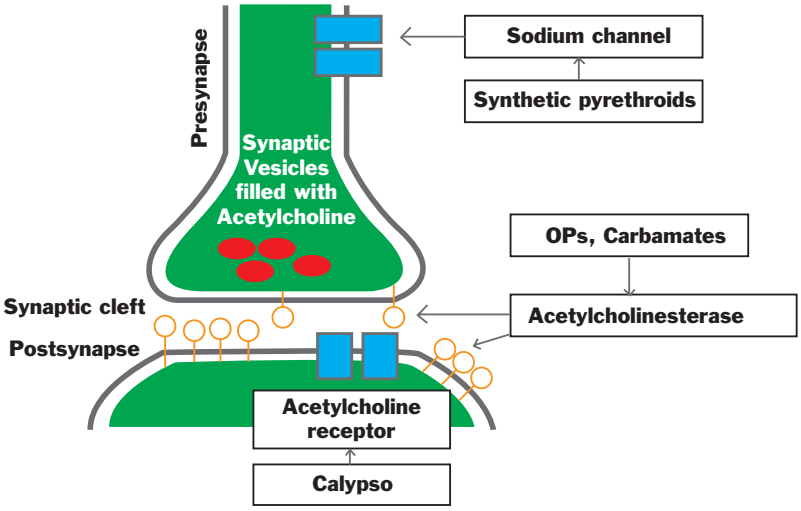
Calypso provides good residual action and acts as an acute stomach and contact poison. Like all CNIs (Group 4A insecticides), Calypso selectively acts on the insect's nervous system as an agonist of the nicotinic acetylcholine receptor (nAChR), thus disturbing signal transmission in the insect's nervous system. In insects, acetylcholine is the major excitatory neurotransmitter. It mediates excitation primarily by activating nicotinic acetylcholine receptors that are widely expressed in the insect nervous system.

The unique mode of action of Calypso means there is no cross resistance to conventional codling moth insecticides such as SPs, OPs, carbamates and the insect growth regulators (IGRs). Consequently, Calypso is an excellent tool for insecticide resistance management strategies.

In pome fruit, field trials have proven the strong efficacy of Calypso against tortricids like CM, OFM, ADB and WAA. With CM these findings are based on four major facts:

FIGURE 1

Target sites of insecticides

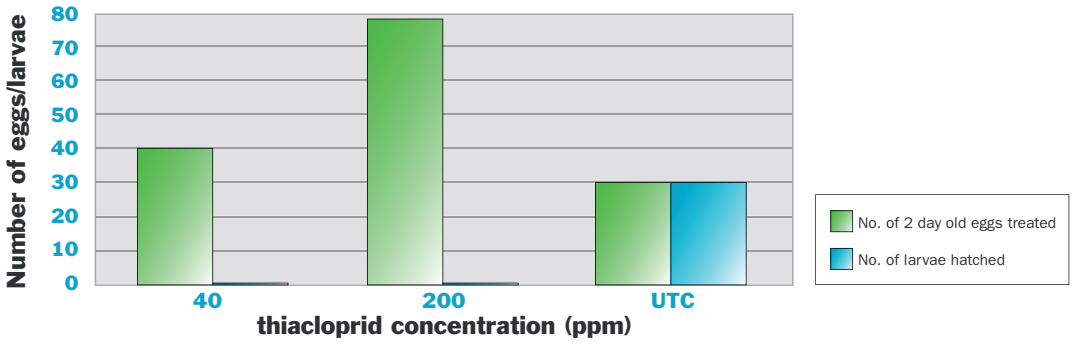


1. Ovicidal efficacy against codling moth

The ovicidal action of Calypso has been demonstrated in both the laboratory and in semi-field trials conducted at the experimental station in Gorsem, Belgium. In all trials, when thiacloprid is applied to freshly laid eggs, the number of larvae hatching is significantly reduced.

FIGURE 2

Ovicidal activity of Calypso after spray applications against 2 day old eggs of codling moth



This ovicidal action of thiacloprid against CM varies significantly dependent on the different developmental stages of the pest or timing of application in relation to oviposition.

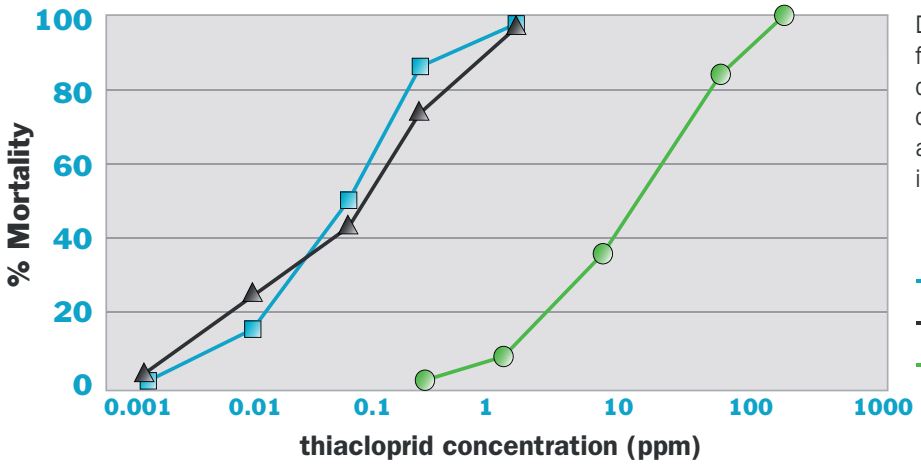
Treatment at different development stages	No. of fruits	% fruit infested
1. Untreated control	61	100%
2. Moths released into cages after spray dried	64	19%
3. Tree sprayed at peak of oviposition (young eggs)	53	2.5%
4. Tree sprayed at black head stage (old stage eggs)	100	50%

FIGURE 3

Semi field test (trees covered with gauze) with controlled release of adult codling moths: 10 male & 10 female (Gorsem/ Belgium 1999 - 2002)

2. Codling moth larvae are efficiently controlled, LD_{50} <0.1 ppm

In a diet incorporation bioassay, thiacloprid showed excellent efficacy against first and second instar CM larvae, which are most likely to be exposed to spray coverage in real field situations.



Dose-response relationship for Calypso against different larval instars of codling moth assessed after 4 days in a diet incorporation bioassay.

FIGURE 4

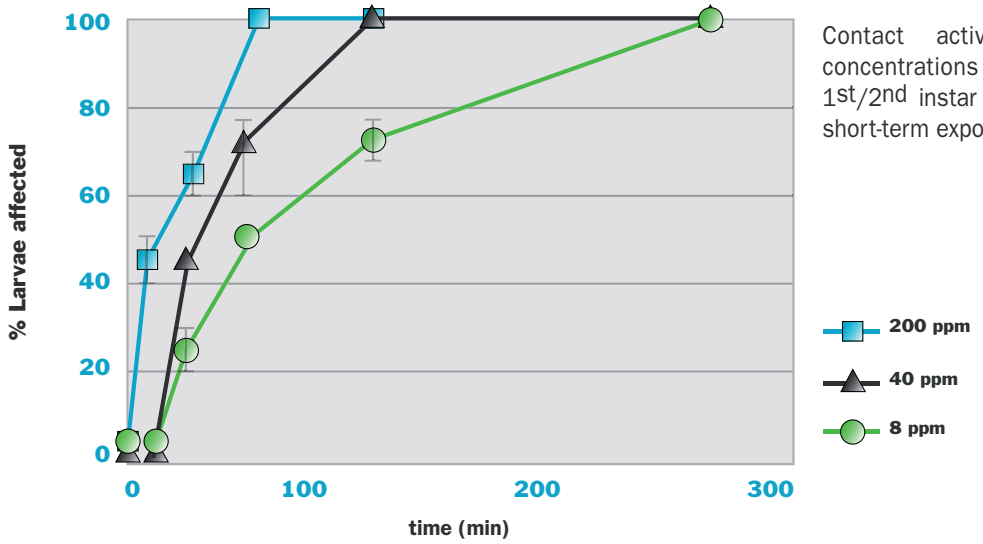
Dose-response relationship for Calypso against larval instars of codling moth

3. Young codling moth larvae are quickly controlled

A contact bioassay, which tests the speed of action of thiacloprid against $1^{st}/2^{nd}$ instar codling moth larvae resulted in 100% affected larvae after only 60 minutes of exposure to a surface dried film treated with 200 ppm of thiacloprid.

FIGURE 5

Contact activity of different concentrations of thiacloprid against CM larvae



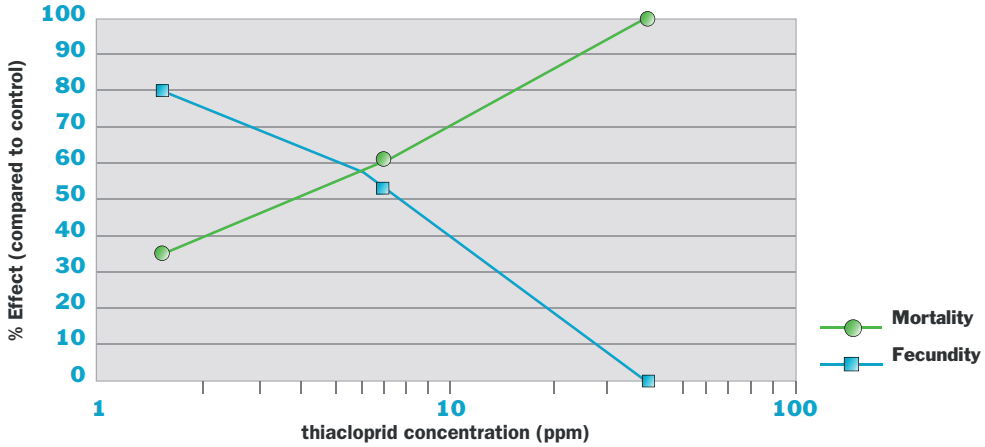
Contact activity of different concentrations of thiacloprid to 1st/2nd instar larvae of CM after short-term exposure.

4. Codling moth adults are controlled when they come into tarsal contact with treated surfaces

A tarsal contact bioassay was utilised to simulate field exposure of female adults to thiacloprid spray coverage. Virgin female moths exposed for 30 minutes to thiacloprid treated surfaces were paired with male moths. After three days mortality and fecundity were assessed. As seen below, exposure of female moths for 30 minutes to 40 ppm thiacloprid treated surfaces was sufficient to result in 100% mortality within 3 days of the exposure. Furthermore, at rates as low as 7 ppm a high level of mortality was achieved (>60%) and surviving females had reduced reproductive capacity.

FIGURE 6

Effects on CM adults after 30 minute tarsal exposure to a surface treated with thiacloprid (Nauen, 1998)



Uptake and translocation

The translaminar and acropetal movement of thiacloprid was tested against green peach aphid (*Myzus persicae*) on cabbage leaves*. The leaves were treated with 3 drops of a 500 ppm thiacloprid solution on the upper surface, and aphids were confined to the underside of the leaves at two different positions (Figure 7) using clip cages. The results were compared to the action of acetamiprid in the same bioassay design.

* Calypso is not registered for control of green peach aphid, or for use on cabbages. This data is provided to demonstrate uptake and translocation of Calypso in plants.

Schematic drawing showing the droplet sites (3 x 5 µL containing 2.5 µg a.i. each) at the basal region on the upper surface of the first true leaf and both infestation areas (leaf underside) with 10 green peach aphids in clip cages for determination of translaminar and acropetal systemicity of thiacloprid.

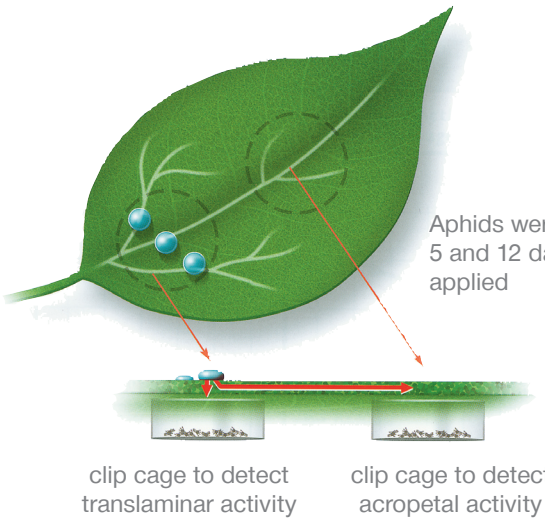
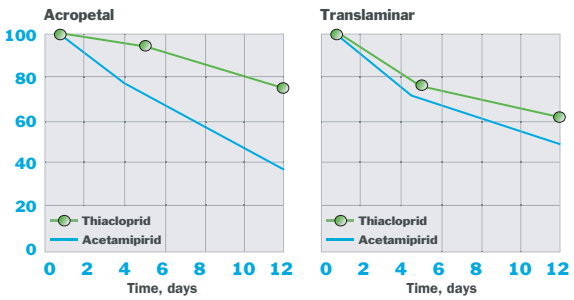


FIGURE 7

Bioassay for determining systemic activity of thiacloprid

These laboratory studies revealed that the translaminar activity of thiacloprid against green peach aphid on cabbage is very good. Control of the aphids placed on the underside of the leaf in 2 positions clearly confirmed that thiacloprid was systemically translocated. Aphids feeding furthest from the application sites showed mortality only one day after application, indicating rapid acropetal translocation of the active ingredients within the leaf (Figure 8).



Systemic translaminar efficacy of selected chloronicotinyl insecticides against green peach aphid on cabbage leaves treated on the upper side (3 droplets of 5 µL, each containing 2.5 µg a.i.). 'Translaminar' efficacy resulted from the mortality of aphids feeding close to the application sites, and 'acropetal' efficacy from the mortality of aphids feeding furthest from the application sites. In both cases aphids were confined to the lower side of the 1st true leaf.

FIGURE 8

Speed of translaminar and acropetal systemic activity of thiacloprid against green peach aphid on cabbage leaves

Twelve days after treatment, thiacloprid still provided moderate control of newly introduced green peach aphid feeding underneath the application site. Acetamipirid was slightly less effective than thiacloprid.

Under practical field situations, foliar sprays at recommended dose rates and application volumes provide a more homogeneous coverage of the leaves, which leads to greater residual activity compared to this laboratory approach, which was specifically designed to provide evidence of the translaminar and systemic action of thiacloprid. Furthermore, chloronicotinyl insecticides such as thiacloprid are excellent contact insecticides.

Resistance

Calypso is a modern, site-specific insecticide belonging to the CNI class of chemistry (Group 4A insecticide). Some naturally occurring insect biotypes resistant to Calypso and other Group 4A insecticides may exist through normal genetic variability in any insect population. When site-specific insecticides are introduced without a clear resistance management strategy, resistance development may be rapid and quickly diminish the usefulness of new insecticides. Because resistance development cannot be predicted, implementing suitable strategies involving rotation with insecticides having a different mode of action and limiting the total number of applications per season of each insecticide group is recommended.

While Calypso does exhibit cross resistance to other Group 4A insecticides there is no known cross-resistance of Calypso or other Group 4A insecticides to insecticides of other classes, including acetyl choline esterase inhibitors (Group 1A and 1B insecticides), the juvenile hormone mimics (Group 7A insecticides) and the voltage dependent sodium channel blockers (Group 22A insecticides).

Behaviour in the environment

Crop protection products applied in accordance with good agricultural practices should have no adverse effects on the environment.

In soil

The degradation of the active ingredient of Calypso, thiacloprid, in soil under aerobic conditions occurs rapidly with a DT_{90} of 12 - 29 days, depending on soil type.

Depending on the soil type, thiacloprid is characterised by a low or medium mobility. Some polar metabolites, but not the parent compound, were found in the leachate of a lysimeter study. However, the degradation products are of no toxicological or ecotoxicological concern.

In a laboratory test at 20°C the LC_{50} (14 day value) of thiacloprid for earthworms (*Eisenia fetida*) was determined to be 105 mg/kg dry weight substrate, indicating slight toxicity. However, under practical field conditions thiacloprid is not expected to have an adverse impact on earthworms or soil micro-organisms.

In water

In water, thiacloprid is hydrolytically stable at pH 5 - 9 and in the water-sediment system, thiacloprid is rapidly degraded to relatively low toxicity metabolites. Consequently there is no potential for persistence or accumulation of thiacloprid or toxic metabolites in the aquatic environment.

Aquatic organisms

Rainbow trout (*Oncorynchus mykiss*)
96 h LC_{50} at 10.5°C 30.5 mg/L

Waterflea (*Daphnia magna*)
48 h EC_{50} at 20°C 85.1 mg /L

Green algae (*Scenedesmus subspicatus*)
72 h EC_{50} at 20°C 97 mg /L

Other aquatic invertebrates revealed a higher sensitivity to thiacloprid, especially insect larvae and amphipod species. While the rapid dissipation of thiacloprid in water bodies allows a rapid recovery of affected aquatic insect populations, a number of warnings and precautionary statements appear under the heading "Protection of Wildlife, Fish, Crustaceans and Environment" on the Calypso label.

Birds

The acute oral LD_{50} studies for representative bird species resulted in the following. LD_{50} Japanese quail (*Coturnix coturnix japonica*): 49 mg/kg b.w.

Bees

Several overseas studies have confirmed the safety of Calypso to essential pollinators such as honeybees. Due to the relatively low toxicity of thiacloprid to honeybees (Table 2), Calypso is suitable for application during the flowering period. In line with good agricultural practice, it is not recommended that Calypso be applied when bees are actively foraging.

TABLE 2

Intrinsic toxicity of thiacloprid to honeybees

	Dose which kills 50% of honeybees (µg/bee)*		Difference in acute toxicity in comparison to Dimethoate
	Thiacloprid	Dimethoate	
Oral dose	17.32	0.15	115 Fold
Tropical (contact) dose	38.83	0.12	323 Fold

* SOURCE: The Pesticide Manual – 14th edition

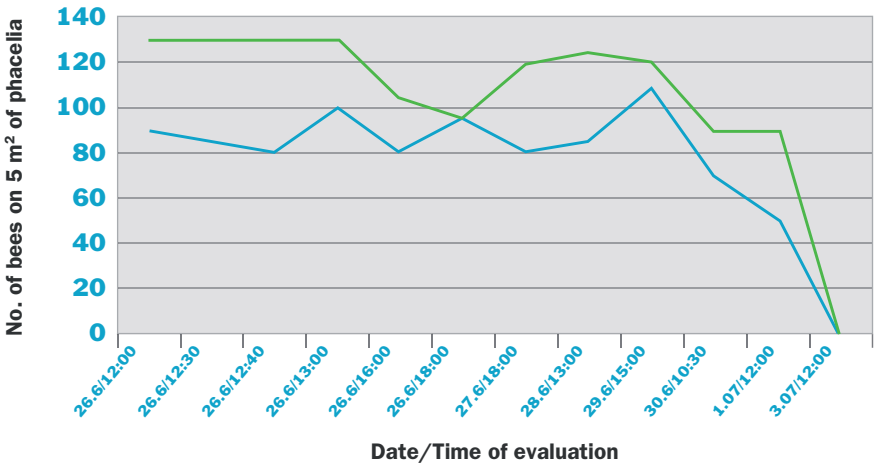


FIGURE 9

Field test: Influence on foraging activity of honeybees in phacelia (Treatment 26.6/11:30am)

Beneficial species

Calypso is well tolerated by a range of beneficial species and is much softer on some beneficial species than conventional insecticides used for either CM, OFM or ADB control.

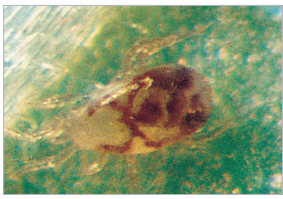
Calypso is compatible with farming systems that utilise predatory mites as part of a pest management strategy. Both local and overseas studies have confirmed that when used as directed Calypso has no adverse effect on predatory mites.

In an Australian trial (Table 3), four applications of each insecticide were applied between 31st October and 11th December and then the impact of each program on the activity of predatory mites was assessed for the remainder of the growing season. None of the treatments had an adverse effect on the development of predatory mites. However, as occurs naturally, predatory mite numbers varied depending on their food source (two-spotted mite).

Formulation	Rate/100 L	8 DAA	29 DAA	50 DAA	75 DAA	97 DAA	Cumulative mean
1. CALYPSO	37.5 mL	0.8 a	4.8 a	17.6 a	55.2 a	56.0 a	26.88 a
2. GUSATHION®	245 mL	1.6 a	4.8 a	4.8 b	18.4 c	37.6 b	13.44 b
3. AVATAR® *	25 g	5.6 a	7.2 a	8.0 ab	39.2 b	51.2 a	22.24 a
4. Untreated control		6.4 a	12.0 a	9.6 ab	19.2 c	28.0 b	15.04 c
LSD 95 %		6.33	8.79	11.67	11.62	11.39	5.96

* plus AGRAL 25 mL/100 L; Trial: BAYER/2578/1

TABLE 3

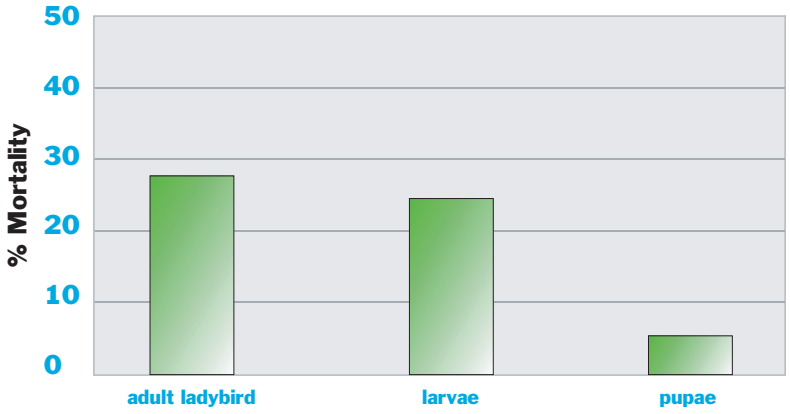


Mean percentage of leaves infested with predatory mites, Nashdale NSW (2002/03)

Calypso is considered moderately harmful to cocconellids, affecting ladybird adults and larvae through both direct contact and by reducing the food source for these predators, causing their numbers to fall. However Calypso has no effect on pupal stages of ladybirds, so some recovery of the population can be expected.

FIGURE 10

Effects of Calypso spray on ladybirds



NOTE: In the above figure the concentration of thiacloprid evaluated in this semi-field trial is equivalent to 20 mL/100 L of Calypso 480 SC which, in Australia, in below the label rate of 37.5 mL/100 L. In essence this would not change the classification of Calypso as "moderately harmful" to cocconellids.

The hymenopteran parasitoids contribute to the regulation of several important pests of fresh fruit such as woolly apple aphid. The winged stage of these parasitic wasps is free living and therefore readily exposed to freshly applied insecticides and their spray residues. Overseas laboratory studies have shown that adult parasitic wasps were adversely affected when directly exposed to thiacloprid or its fresh spray deposit, but those wasps exposed to an aged spray residue of Calypso survived. With one wasp species assessed, this negative effect largely disappeared in less than a week.

Results from laboratory and semi-field experiments where Calypso was applied directly to parasitised aphid mummies have confirmed that Calypso has no effect on the juvenile stages of parasitic wasps inside the host. As it does not penetrate the hardened cuticle of parasitised aphids, these parasitic wasp stages act as a reservoir for the quick recovery of the parasitoid population.

The influence of Calypso on the successful parasitism of aphids was investigated in a field trial. Under practical field conditions, as the histogram below clearly shows, Calypso does not reduce the level of parasitism of woolly apple aphid by *Aphelinus mali.*

FIGURE 11

Effect of thiacloprid on the parasitisation of woolly aphids by *Aphelinus mali*

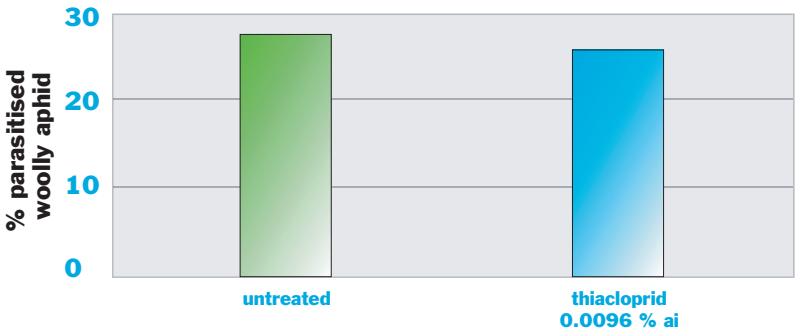


Photo supplied courtesy Department of Primary Industries Victoria

NOTE: In the above figure the 0.0096 % concentration of thiacloprid evaluated in this field trial is equivalent to 20 mL/100 L of Calypso 480 SC which, in Australia, is below the label rate of 37.5 mL/100 L. Nevertheless, local commercial experience suggests this higher rate is still not expected to adversely impact on the parasitisation of woolly apple aphid by *A. mali.*

Maximum residue limits

Growers should note that MRLs or import tolerances do not exist in all markets for fruit treated with Calypso. There are currently 37 countries, including EU, with MRL's for Calypso. If you are growing fruit for export, please check with Bayer CropScience Pty Ltd for the latest information on MRLs and import tolerances before using Calypso. The following information on MRLs was current as of 1st July, 2007.

Country	Crop	MRL (mg/kg)
Argentina	Apple, pear	0.5
	Peach	0.3
Austria	Pome fruit	0.3 (provisional)
	Apricot, cherry, nectarine, peach	0.3 (provisional)
	Plum	0.1 (provisional)
Australia	Pome fruit	1.0
	Dry apple pomace	3.0
	Stone fruit	2.0
Belgium	Apple, pear	0.5
	Cherry	0.2
	Plum	0.1
Bulgaria	Apple	0.5 (provisional)
	Cherry	0.5 (provisional)
Canada	Apple, pear	0.3
	Stone fruit	0.1 (default)
Czech Republic	Apple	0.3
	Cherry	0.2
	Peach, nectarine, apricot	*0.05
	Pear (Pome fruit, others)	*0.05
Denmark	Pome fruit	0.3 (provisional)
	Apricot, cherry, peach	0.3 (provisional)
	Plum	0.1 (provisional)
Estonia	Pome fruit	0.3 (provisional)
	Apricot, cherry, peach	0.3 (provisional)
	Plum	0.1 (provisional)
European Community	Pome fruit	0.3 (provisional)
	Apricot, peach, cherry, nectarine	0.3 (provisional)
	Plum	0.1 (provisional)
Finland	Pome fruit	0.3 (provisional)
	Apricot, cherry, peach	0.3 (provisional)
	Plum	0.1 (provisional)
France	Apple, pear	0.5
	Apricot, peach	0.2
	Plum	0.1 (provisional)

Country	Crop	MRL (mg/kg)
Germany	Pome fruit	0.3 (provisional)
	Peach, apricot, plum	0.1 (provisional)
	Cherry	0.2 (provisional)
Greece	Apple, pear	0.3 (provisional)
	Apricot, peach, nectarine	0.3 (provisional)
	Cherry	0.2 (provisional)
Hungary	Pome fruit	0.3
	Cherry	0.3
Ireland	Pome fruit	0.3 (provisional)
	Apricot, cherry, peach	0.3 (provisional)
	Plum	0.1 (provisional)
Israel	Apple, pear	0.1
	Nectarine, plum, peach	0.02
Italy	Apple, pear	0.5
	Apricot, nectarine, peach	0.3
Japan	Apple, pear	2.0 (provisional)
	Peach	1.0 (provisional)
	Apricot, plum, cherry	5.0 (provisional)
	Nectarine	2.0 (provisional)
Korea, republic of	Apple	0.3
	Pear	0.2
	Peach	0.1
Lithuania	Pome fruit	0.3 (provisional)
	Apricot, cherry, peach	0.3 (provisional)
	Plum	0.1 (provisional)
Luxembourg	Apple, pear	0.5
	Cherry	0.2
	Plum	0.1
Mexico	Apple	0.3
Netherlands	Pome fruit	0.3
	Peach, apricot, cherry, nectarine	0.3
	Plum	0.05 (provisional)
New Zealand	Pome fruit	*0.02
	Stone fruit	*0.02

Country	Crop	MRL (mg/kg)
Norway	Pome fruit	0.3 (provisional)
	Apricot, cherry, peach	0.3 (provisional)
	Plum	0.1 (provisional)
Poland	Pome fruit	0.3
	Stone fruit	0.3
Portugal	Apple, pear	0.5
	Cherry	0.2
	Plum	0.1
	Peach	0.5
Slovakia	Apple	0.3
	Cherry, plum	0.2
	Peach, nectarine, apricot	*0.05
Slovenia	Pome fruit	0.3 (provisional)
	Apricot, cherry, peach	0.3 (provisional)
	Plum	0.1 (provisional)
South Africa	Apple, pear	1.0
	Peach, nectarine	0.1
Spain	Apple, pear	0.5 (provisional)
	Peach, apricot, nectarine	0.2 (provisional)
	Cherry, plum	*0.2 (provisional)
Sweden	Pome fruit	0.3 (provisional)
	Apricot, cherry, peach	0.3 (provisional)
	Plum	0.1 (provisional)
Switzerland	Pome fruit	0.3
	Stone fruit	0.3
Turkey	Apple	0.5
	Cherry	0.2
United Kingdom	Apple	0.5 (provisional)
	Pear	0.4 (provisional)
	Cherry	0.5 (provisional)
	Plum	0.1 (provisional)
USA	Pome fruit	0.3

* At or about the limit of quantitation for analysis of the residue.

Guideline for use of Calypso

Codling Moth

Codling moth (*Cydia pomonella*) (CM) is an important pest in most apple growing regions around Australia. Depending on regional climatic conditions, up to three generations of codling moth can occur during the growing season. Since the larvae live within the fruit during their development, successful control with insecticides depends mainly on precisely timed spray applications. Effective early control is therefore essential in minimizing the impact this pest has on marketable yield.

Calypso has been widely evaluated under a range of pest pressures and has demonstrated excellent control of codling moth. As the direct insecticidal effects of Calypso controls young larvae and adults as well as freshly laid eggs, to cover all development stages it is recommended to apply Calypso at egg lay (110 degree days) of the 1st generation, as indicated by monitoring.

Apply Calypso as a block of four treatments leaving not more than 14 days between successive treatments. For the remainder of the season, continue to monitor, applying other control measures as required.

Applying Calypso as a series of 4 sprays commencing at egg lay of the first generation provides 56 days of protection against codling moth, covering both the 1st generation and the 2nd cohort or bi-modal peak of the 1st generation.

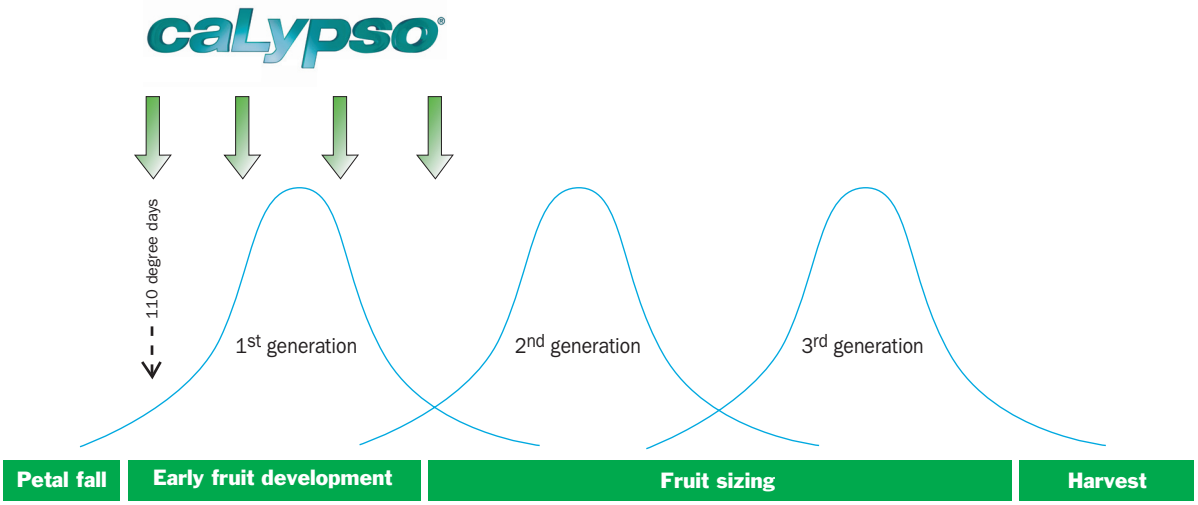


FIGURE 12

Calypso positioning

Oriental Fruit Moth

Calypso has been widely evaluated against oriental fruit moth (*Grapholita molesta*) (OFM) and has easily demonstrated superior control to industry standards.

Calypso not only controls young larvae before they attack shoots and fruit, but can also control young OFM larvae that have burrowed into shoot tips prior to a Calypso application. This combined protection of leaf and fruit surfaces as well as inside shoot tips provides growers with a unique tool to significantly reduce the level of damage associated with OFM infestations.

Calypso should be used in a program of 3 sprays at 14 day intervals to control any single generation of OFM.

Apple Dimpling Bug

Apple dimpling bug (*Campylomma liebknechti*) (ADB) is the most damaging early season pest of apples and in some seasons can result in a significant amount of crop loss. This is mainly as a result of early feeding damage on embryonic fruit that later manifests itself as deformed unmarketable fruit at harvest. As the apple fruit sets and increases in size it becomes less susceptible to ADB injury.

Apple dimpling bug is a widespread pest that occurs throughout all apple-growing districts of Australia and routine early season insecticide sprays are required in most seasons for effective control.

Insecticides that are currently available to control or manage ADB have increasingly limited flexibility in today's orchard pest management due to a lack of compatibility with IPM programs.

Directions for use

Crop	Pest	Rate	Critical comments
Apples	Apple dimpling bug	**Dilute spraying** 37.5 mL/100 L	Correctly timed applications of Calypso will significantly reduce fruit damage caused by apple dimpling bug, however a substantial reduction in pest numbers may not always be evident. Apply an initial spray from pink stage to petal fall when pest numbers reach accepted threshold levels as indicated by monitoring. Spray thoroughly to ensure complete coverage of flower parts and developing fruitlets, using dilute spraying equipment. A second spray (up to a total of two Calypso applications during flowering) and/or other control measures may be necessary under high pest pressure.
Pome fruit	Codling moth, oriental fruit moth	**Dilute spraying** 37.5 mL/100 L **Concentrate spraying** Refer to the Mixing/ Application section	**Codling moth**: Apply a total of 4 sprays at 14 day intervals commencing at egg lay (110 degree days) of the first generation as indicated by monitoring. For the remainder of the season, continue to use other control measures. Do not apply more than 4 Calypso sprays per season (this does not include prior use of up to 2 applications of Calypso for apple dimpling bug control). Control of the second generation of oriental fruit moth may be achieved by the Calypso applications targeting codling moth where populations of these pests coincide. **Oriental fruit moth**: For specific control of an oriental fruit moth generation apply 3 Calypso sprays at 14 day intervals commencing at egg hatch as indicated by monitoring. For the remainder of the season, continue to use other control measures. Do not use this program before or after a program of Calypso applications for codling moth control, as no more than 4 Calypso sprays should be applied per season (this does not include prior use of up to 2 applications of Calypso for apple dimpling bug control). **Application**: Apply thoroughly to ensure complete coverage. 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. For concentrate spraying, do not use at rates greater than 112.5 mL per 100 L of water (i.e. at a concentration factor greater than 3x). **Woolly aphid**: When Calypso is used for the control of codling moth or oriental fruit moth as indicated, early season sprays for the control of woolly aphid will not be required. For the remainder of the season, monitor aphid populations and apply other control measures as required.

Directions for use (continued)

Crop	Pest	Rate	Critical comments
Stone fruit	Oriental fruit moth	**Dilute spraying** 37.5 mL/100 L **Concentrate spraying** Refer to the Mixing/ Application section	Apply in a series of 3 sprays at 14 day intervals commencing at egg hatch of a generational peak as indicated by monitoring. Apply thoroughly to ensure complete coverage. For the remainder of the season, continue to use other control measures. Do not apply more than 3 Calypso sprays per season. 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. For concentrate spraying, do not use at rates greater than 112.5 mL per 100 L of water (i.e. at a concentration factor greater than 3x). **Add a non-ionic wetting agent at 10 mL/100 L regardless of whether applying by dilute or concentrate spraying.** **Green peach aphid**: Where Calypso is used for the control of oriental fruit moth as indicated, sprays for the control of green peach aphid will not be required.

Withholding periods

Peaches and pome fruit: DO NOT harvest for 21 days after application

Apricots, cherries, nectarines, plums: DO NOT harvest for 14 days after application

DO NOT GRAZE ANY PLANTS THAT WERE PRESENT IN THE SPRAYED AREA AT THE TIME OF APPLICATION.

Compatibility

Calypso is physically compatible, when used post-flowering, with most commonly used insecticides and fungicides, including:

- ☑ Bogard® 100 WG
- ☑ Calcium nitrate (technical grade)
- ☑ Captan WG
- ☑ Delan® 700 WG
- ☑ Dithane® DF
- ☑ Flint® 500 WG
- ☑ Stopit®
- ☑ Mimic® 700 WP
- ☑ Omite® 300W
- ☑ Rubigan® 120 SC
- ☑ Systhane® 400 WP
- ☑ Ziram Granuflo™

As the formulations of other company's products are beyond the control of Bayer CropScience, all mixtures should be tested before mixing in commercial quantities.

Field performance on pome fruit

Codling Moth (CM)

In Australian trial work, Calypso 480 SC Insecticide has been shown to have excellent activity on CM in pome fruit. Furthermore, when applied as a block of 4 sprays for the control of CM, Calypso provides useful suppression of woolly apple aphid. The results below demonstrate the strong performance of Calypso against CM.

FIGURE 13

Trial EMH 421
Stanthorpe Qld
1997/98

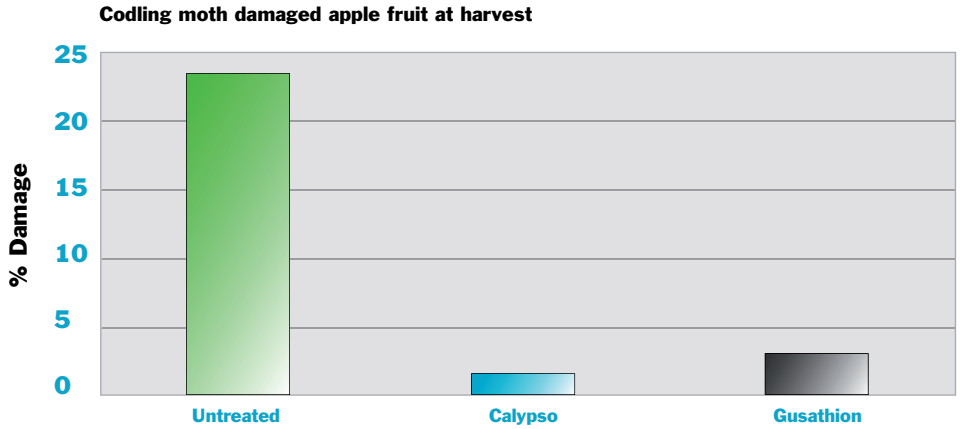
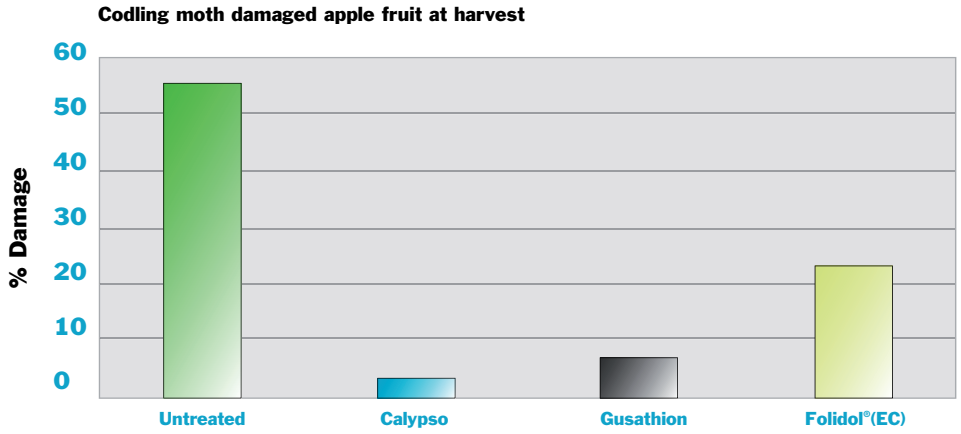


FIGURE 14

Trial PJH 325
Bathurst NSW
1999/00



In the above trials, conducted under moderate to high pressure and with probable azinphos-methyl tolerance, Calypso, Gusathion and Folidol® M500 were applied on 7 occasions to red delicious apples. Spray intervals were 14 days early in the season and lengthened to 21 days later (Figures 13 and 14).

In Figure 15 (Trial RTL 590), at a high codling moth pressure site, Calypso was applied in a program comparing 9 Calypso sprays to four sprays of Calypso followed by 5 sprays of Gusathion 200SC or 9 sprays of Gusathion 200SC. Spray intervals were 14 days early in the season and lengthened to 21 days later.

In the above three trials Calypso was applied in a program of 7 or 9 applications which is contrary to label directions. This was done to thoroughly evaluate the efficacy and robustness of Calypso without the influence of other insecticides on its performance.

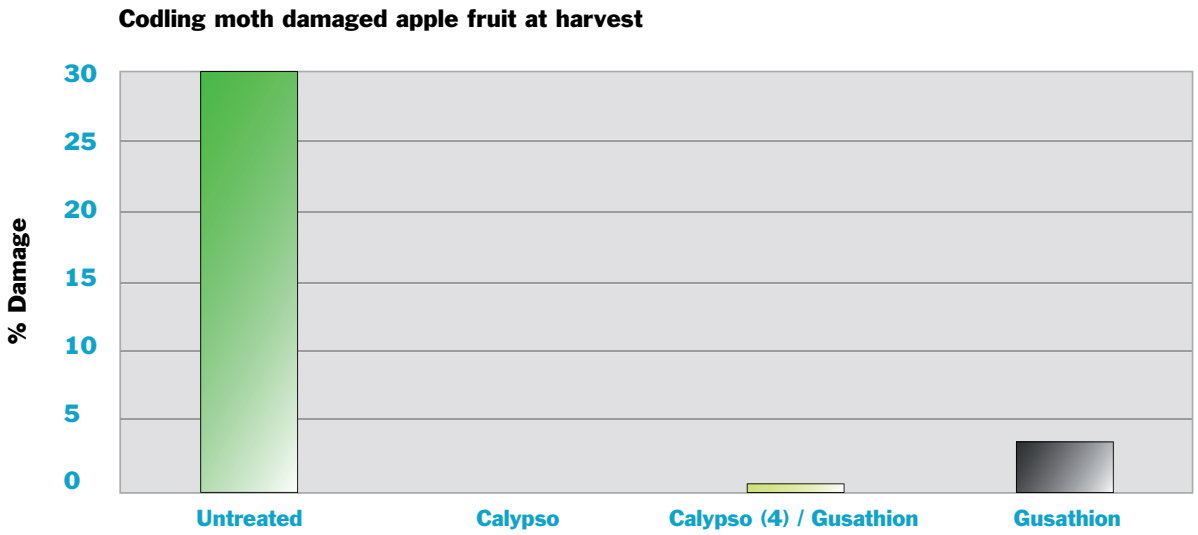


FIGURE 15

Trial RTL 590
Cobram Vic
2000/01

In trial RTL 591 (Figure 16), Calypso applied to red delicious apples as the first four applications as part of a codling moth spray programme was compared with four sprays of Gusathion to evaluate woolly aphid control. Spray intervals were 14 to 16 days. Additional Gusathion sprays were applied for the remainder of the season. The results show that 4 sprays of Calypso provided good early season control of woolly apple aphid, which extended for at least 76 days after the last application of Calypso.

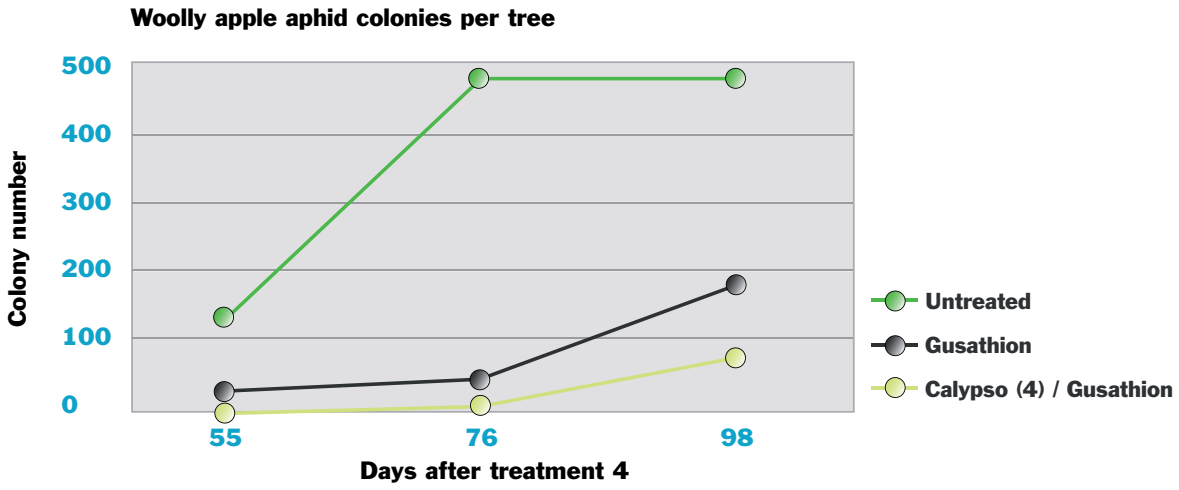


FIGURE 16

Trial RTL 591
Shepparton Vic
2000/01

Apple Dimpling Bug (ADB)

The following trials demonstrate that when Calypso is used as a thoroughly applied foliar spray from pink stage to full bloom at a rate of 37.5 mL/100 L, ADB is effectively controlled relative to the current standard insecticides.

FIGURE 17

Trial EMH 422 Thulimbah Qld 1997/98

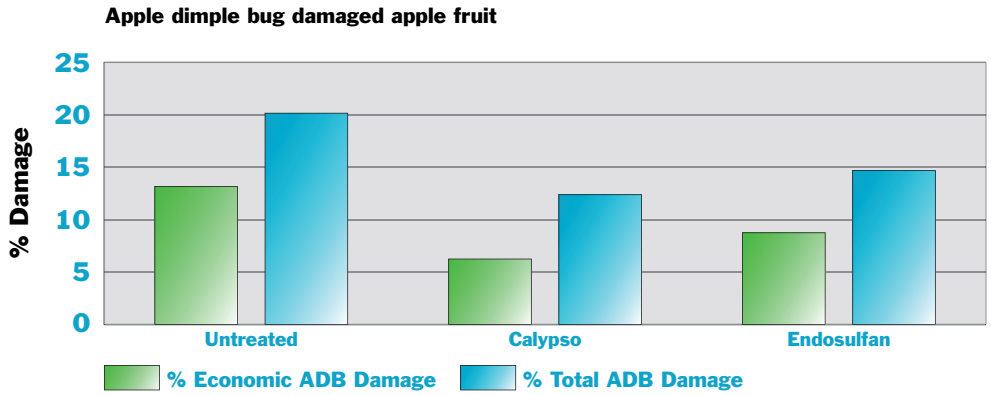
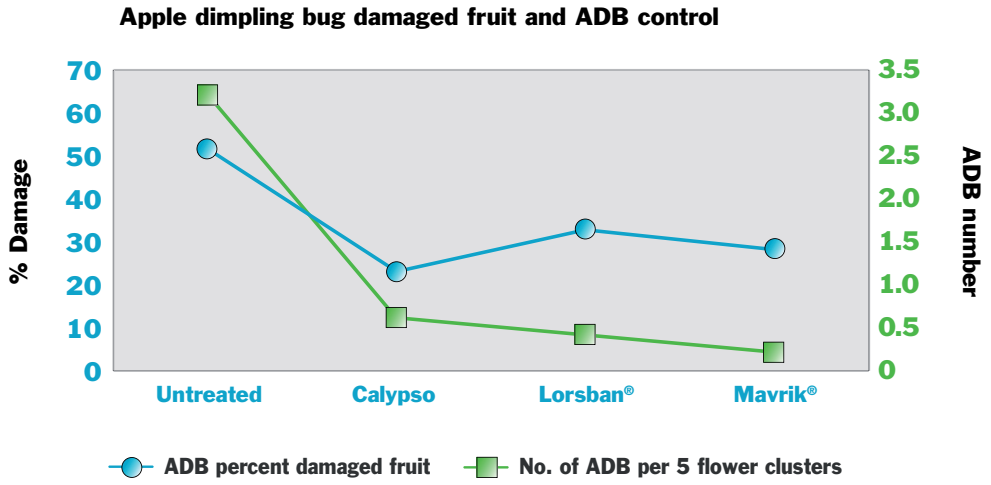


FIGURE 18

Trial RTL 589 Stanthorpe in Qld 2000/01



An assessment of apple dimpling bug numbers, four days after application, showed that the two standard treatments and Calypso 37.5 mL/100 L were associated with a significant reduction in the number of apple dimpling bugs in flower clusters, compared with the untreated control.

Despite the inconsistent effect of Calypso on pest numbers, apple dimpling bug fruit damage was significantly reduced following a single application of Calypso 37.5 mL/100 L in this case (Figure 17 and 18).

Calypso showed equivalent or better control of ADB infestation and fruit damage, to the standard Lorsban treatment, when applied in a single spray at late pink (Figure 19). Pressure in this trial was demonstrated to be high, by the level of infestation and pre-thinning fruit damage in a block of untreated control trees. Severe infestation in the untreated trees was also reported to have led to natural fruit abortion, which resulted in some difficulty in the fruit sampling.

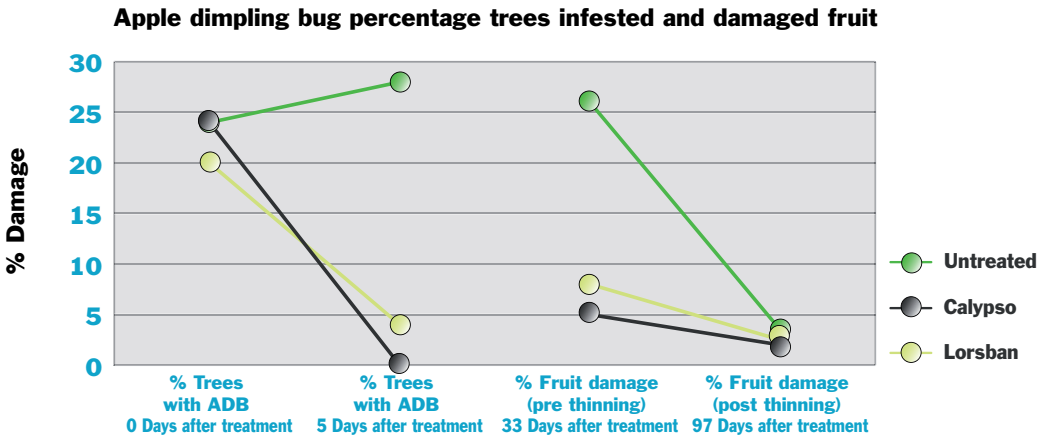


FIGURE 19

Trial VC16B04 Pink Lady, Perth Hills, WA 2004

Oriental Fruit Moth (OFM)

Oriental fruit moth (*Grapholita molesta*) is a new and emerging pest in pome fruit crops, where it has migrated from adjacent stone fruit crops in recent years. Calypso is already registered for control of oriental fruit moth in stone fruit and the closely related codling moth in pome fruit. The following trials demonstrate that when used in a programme at a rate of 37.5 mL/100 L, oriental fruit moth is just as effectively controlled in pome fruit with Calypso as it is in stone fruit.

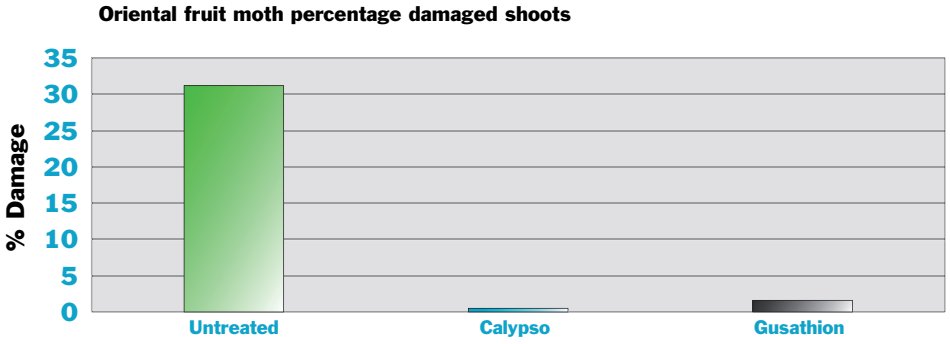


FIGURE 20

Trial VC31 Beurre Bosc Pears, Shepparton, Vic

In a replicated hand sprayed trial at Shepparton, Victoria, in 2004 Calypso 480 SC (480 g/L thiacloprid) was evaluated at 37.5 mL/100 L in a programme with the standard Gusathion for the control of oriental fruit moth (*Grapholita molesta*) infesting a block of Buerre Bosc pears (Figure 20).

Calypso and Gusathion in a programme of six sprays resulted in a significant reduction in the level of shoot tip damage associated on this pear variety with this pest and there was no fruit damage with either oriental fruit moth or codling moth observed throughout the trial.

Field performance on stone fruit

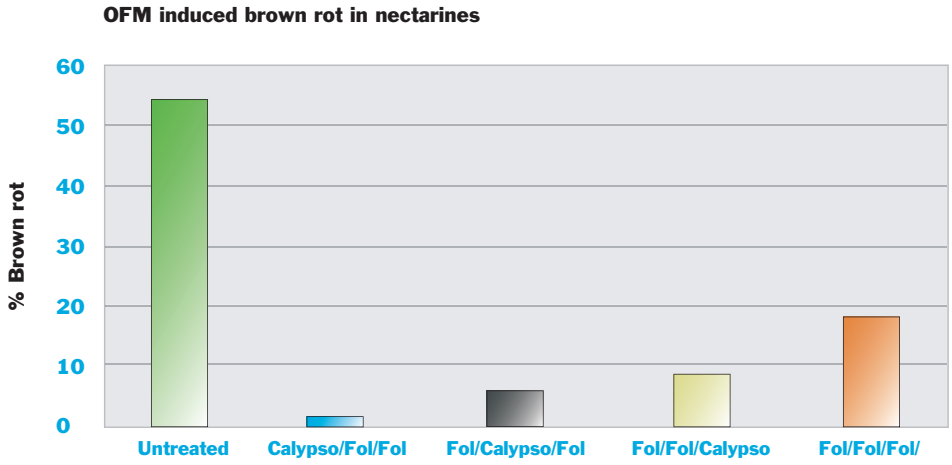
Brown Rot

In the absence of a late season fungicide programme, the percent of fruit infected with brown rot can be directly correlated to the level of OFM activity. This measure is employed in the below trial to highlight the effectiveness of various spray programmes against OFM (Figure 21).

Using Calypso in a block of sprays with Folidol® 450 CS (Fol) against the 1st, 2nd or 3rd OFM generations proved significantly more effective than a straight Folidol programme (3 blocks of three sprays).

FIGURE 21

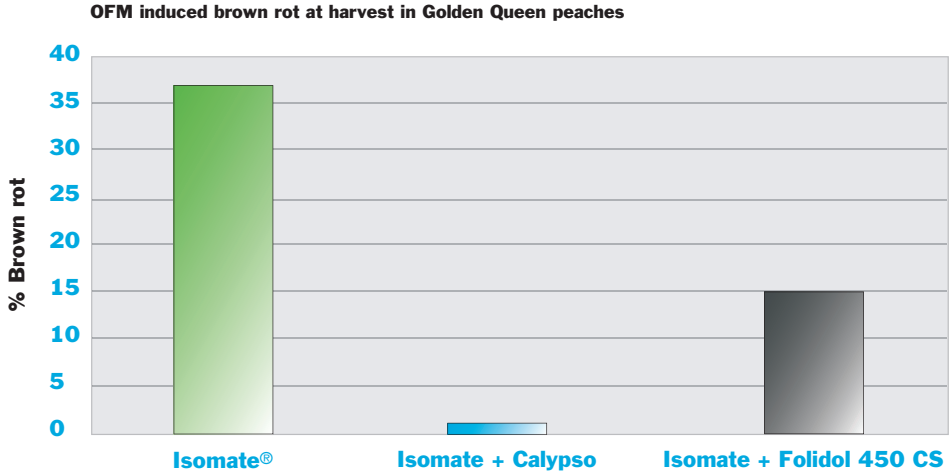
Trial RTL 577
Shepparton Vic
2001



Where pest pressures are too high for mating disruption alone, the strategic use of Calypso to reduce the population pressure in conjunction with mating disruption provides growers with an important and unique management tool for OFM. In Figure 22, the use of Calypso as a 'strategic spray' in conjunction with Isomate® OFM Russo proved significantly more effective than either Isomate OFM Russo alone or in conjunction with Folidol 450 CS.

FIGURE 22

Trial RTL 578
Cobram Vic
2000/01



General instructions

Insecticide Resistance Warning

For insecticide resistance management, Calypso is a Group 4A insecticide. Some naturally occurring insect biotypes resistant to Calypso and other Group 4A insecticides may exist through normal genetic variability in any insect population. The resistant individuals can eventually dominate the insect population if Calypso and other Group 4A insecticides are used repeatedly. The effectiveness of Calypso on resistant individuals could be significantly reduced. Since occurrence of resistant individuals is difficult to detect prior to use, Bayer CropScience Pty Ltd accepts no liability for any losses that may result from the failure of Calypso to control resistant insects. Calypso may be subject to specific resistance management strategies. For further information contact your local supplier, Bayer CropScience representative or local agricultural department agronomist.

Mixing/Application

Prior to pouring, shake container vigorously, then add the required quantity of Calypso 480 SC to water in the spray vat while stirring or with agitators in motion.

Dilute Spraying

- Use a sprayer designed to apply high volumes of water up to the point of run-off and matched to the crop being sprayed.
- Set up and operate the sprayer to achieve even coverage throughout the crop canopy. Apply sufficient water to cover the crop to the point of run-off. Avoid excessive run-off.
- The required water volume may be determined by applying different test volumes, using different settings on the sprayer, from industry guidelines or expert advice.
- Add the amount of product specified in the Directions for Use table for each 100 L of water. Spray to the point of run-off.
- The required dilute spray volume will change and the sprayer set up and operation may also need to be changed, as the crop grows.

Concentrate Spraying

- Use a sprayer designed and set up for concentrate spraying (that is a sprayer which applies water volumes less than those required to reach the point of run-off) and matched to the crop being sprayed.
- Set up and operate the sprayer to achieve even coverage throughout the crop canopy using your chosen water volume.
- Determine an appropriate dilute spray volume (See Dilute Spraying above) for the crop canopy. 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

  1. Dilute spray volume as determined above
     e.g. 1500 L/ha
  2. Your chosen concentrate spray volume
     e.g. 500 L/ha
  3. The concentration factor in this example is 3x
     (i.e. 1500 L ÷ 500 L = 3)
  4. As the dilute label rate is 37.5 mL/100 L, then the concentrate rate becomes 3 x 37.5, that is 112.5 mL/100 L of concentrate spray

- The chosen spray volume, amount of product per 100 L of water, and the sprayer set up and operation may need to be changed as the crop grows.
- Do not use a concentrate rate higher than that specified in the Critical Comments.
- For further information on concentrate spraying, users are advised to consult relevant industry guidelines, undertake appropriate competency training and follow industry Best Practices.

Minimising Spray Drift

It is desirable to minimise spray drift onto adjoining pasture to limit the potential for chemical residues in grazing livestock. An effective way to reduce drift potential is to apply as large droplets as possible, i.e. a spray with a volume mean diameter greater than 150 microns. Higher pressure will also reduce droplet size and increase spray drift potential. When higher spray volumes are required, use high capacity nozzles instead of increasing the pressure. Application in conditions such as no wind or strong winds and hot dry conditions will also have a considerable effect on increasing the potential for spray drift. Avoid directing excessive spray above trees and always turn off outward pointing nozzles at end rows and outer rows.

PRECAUTIONS

Re-entry

Do not allow entry into treated areas until the spray has dried. When prior entry is necessary, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and chemical resistant gloves. Clothing must be laundered after each day's use.

Protection of Livestock

Assess the treatment area before application to identify any potential for spray drift to grazing pasture. Employ a spray drift minimisation strategy to avoid drift onto adjoining properties or stock areas. If unexpected conditions cause spray drift to land that could potentially be used for grazing by livestock seek advice from Bayer CropScience.

Protection of Wildlife, Fish, Crustaceans and Environment

This product is very highly toxic to aquatic invertebrates. DO NOT contaminate streams, rivers or waterways with the chemical or used containers. DO NOT apply under weather conditions, or from spraying equipment, that may cause spray to drift onto nearby adjacent areas, particularly wetlands, waterbodies or watercourses. DO NOT spray within 40 metres upwind of wetlands, waterbodies or watercourses. DO NOT apply if heavy rains are expected within 24 hours.

Storage and Disposal

Store in the closed, original container in a cool, well ventilated area. Do not store for prolonged periods in direct sunlight. Triple or preferably pressure rinse container before disposal. Add rinsings to spray tank. Do not dispose of undiluted chemicals on site. If recycling, replace cap and return clean containers to recycler or designated collection point. If not recycling, break, crush or puncture and bury empty containers in a local authority landfill.

If no landfill is available, bury the containers below 500 mm in a disposal pit specifically marked and set up for this purpose clear of waterways, desirable vegetation and tree roots. Empty containers and product should not be burnt.

Safety Directions

Poisonous if swallowed. When opening the container and preparing spray, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing), elbow-length PVC or nitrile gloves and a disposable fume mask. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and elbow-length PVC or nitrile gloves. Wash hands after use. After each day’s use wash gloves and contaminated clothing.

First Aid

If poisoning occurs contact a doctor or Poisons Information Centre (telephone 131 126).

Material Safety Data Sheet

Additional information is listed in the Material Safety Data Sheet, which can be obtained from www.bayercropscience.com.au

Exclusion of Liability

This product must be used strictly as directed, and in accordance with all instructions appearing on the label and in other reference material. So far as it is lawfully able to do so, Bayer CropScience Pty Ltd accepts no liability or responsibility for loss or damage arising from failure to follow such directions and instructions.

Questions and answers

1. How systemic is the active ingredient in Calypso?

Research has revealed that thiacloprid has both translaminar and acropetal mobility. That is, the active ingredient moves readily within the aqueous environment beneath the cuticle from the site of application on the upper surface of a leaf to the opposing side (translaminar movement) and, also moves within the xylem i.e. is translocated in an upward direction. Despite this, Calypso should still be applied at appropriate water volumes and through suitably calibrated equipment to achieve thorough and even coverage.

2. If I get a sudden shower an hour after spraying Calypso, do I have to 'retreat'?

Generally no, Calypso is rainfast as soon as the spray deposit has dried. Retreatment would only be necessary if wash-off occurred before the spray had dried, or an extraordinary rainfall event of prolonged duration occurred within a day of application.

3. How good is Calypso against specific pests of orchard fruit?

When applied as per label directions:

Pest	Rating
Codling moth (*Cydia pomonella*)	✻✻✻✻
Woolly apple aphid (*Eriosoma langerum*)	✻✻
Oriental fruit moth (*Grapholita molesta*)	✻✻✻✻
Green peach aphid (*Myzus persicae*)	✻✻✻✻
Apple dimpling bug (*Campylomma liebknechti*)	✻✻✻✻

Excellent ✻✻✻✻
Good ✻✻✻ (consistent control under low pressure)
Suppression only ✻✻ (additional control measures may still be required)

4. What water rates are appropriate and can I apply in low volumes?

Experience has shown that Calypso can be applied in a wide range of water volumes with excellent results provided that equipment is well calibrated to provide thorough coverage of fruit and foliage and the chemical rate applied is determined from the water volume required to achieve point of run off at any particular growth stage. Calypso should not be used in equipment that requires rates greater than 112.5 mL/100 L of water (3x).

5. Does Calypso impact at all on the activity of beneficial species?

Calypso is well tolerated by a range of beneficial species and is much softer on some beneficial species than conventional insecticides used in orchard fruit production. Calypso does not adversely affect ground and rove beetles, soil mites, spiders, millipedes, predatory mites (e.g. *Typhlodromus pyri, T. occidentalis*), pupal stages of coccinellids and protected stages of parasitic wasps. It is considered slightly harmful to hover flies and lace wings, moderately harmful to mirid bugs and coccinellids, and harmful to adult stages of parasitic wasps and flower bugs. However, under practical field conditions overseas studies have shown that Calypso does not have an adverse effect on the level of parasitisation of woolly apple aphid by *Aphelinus mali*.

6. When should I start the Calypso program?

For codling moth, as there are direct insecticidal effects on young larvae, adults and freshly laid eggs, the optimal timing for spray application is at egg lay (110 degree days) of the 1st generation. Applying Calypso as a block of 4 sprays applied at 14 day intervals against the 1st generation will significantly reduce the number of moths completing subsequent generations.

For oriental fruit moth, Calypso should be applied in a series of 3 sprays at 14 day intervals commencing at egg hatch of a generational peak as indicated by monitoring.

7. After the last application of Calypso what other options do I have?

In either stone fruit or pome fruit after the last Calypso application continue to monitor and apply other control measures as required. There are several insecticides registered for the control of codling moth including Gusathion 200 SC, parathion-methyl, Insegar® and Avatar®, while for oriental fruit moth, there are fewer choices. Both Gusathion and parathion-methyl are widely used for the control of oriental fruit moth. Before deciding on a specific course of action, seek advice to ensure such product usage is within label guidelines.

8. Is Calypso compatible with mating disruption?

Yes, Calypso is compatible with pest management strategies that incorporate mating disruption, as it is one of the fastest acting 'modern' insecticides used to control codling moth or oriental fruit moth that is also well tolerated by a range of beneficial insects.

9. Is Calypso harmful to pollinators?

No. Overseas studies have confirmed the safety of Calypso to honeybees and bumblebees. Therefore it is one of the few insecticides that can safely be applied during the flowering period, providing greater flexibility in spray timing. In line with good agricultural practice, application of Calypso should be avoided when bees are actively foraging.

10. Export is of increasing importance to many top fruit producers in Australia. Are there MRL's or import tolerances established in key export markets for Australian fresh fruit?

As of 1 July 2007 there are import tolerances for pome fruit and/or stone fruit established in 37 countries including Japan, the United Kingdom and the European Union.

caLypso®

Key benefits

- Control of a range of both chewing and sucking insect pests
- Three-way activity against codling moth (young larvae, adults and freshly laid eggs)
- Activity against young OFM and CM larvae on leaf and fruit surfaces and inside shoot tips. Also has activity on ADB and WAA
- A unique mode of action quite distinct to OP, SP, carbamate and IGR insecticides
- Good residual activity and acts as an acute stomach and contact poison
- A wider window of application than IGRs allowing a more flexible application timing
- A genuine 'soft' solution for the effective control of a range of chewing pests in IPM systems

For further information please contact your local chemical reseller or our free call technical information number:

Telephone: 1800 804 479
Fax: 1800 009 388
enquiries.australia@bayercropscience.com
www.bayercropscience.com.au

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