



ISOMATE® OFM Rosso – Technical notes

ISOMATE® OFM ROSSO

A new approach to the control of Oriental fruit moth (Grapholita or Cydia molesta) and Plum fruit moth (Grapholita or Cydia funebrana)

Morphological and biological features of *Cydia molesta*

Adult small moths with brown forewings.

Egg similar to Codling moth eggs (also during embryonic development), but slightly smaller.

Mature larva pink-yellow or reddish coloured.

Pupa brownish or reddish, approximately 6 - 7 mm long



The Oriental fruit moth probably originated in the north of China. Its first appearance in Europe – in Liguria (Italy) – was recorded in 1920. The moth has since spread to other adjacent countries.

Today, the Oriental fruit moth mainly infests rose species and stone fruits (especially peaches, apricots and plum-trees). However, in recent years

it has also become a serious problem for pome fruits, especially when these are planted near stone fruit orchards.



- Oriental fruit moth larvae are shoots, twigs and fruits borers

The moths over winter as fullgrown larvae in cocoons in tree bark crevices, on the ground or in fruit containers.



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The first adults begin to emerge in the middle of march, although emergence varies according to the mean temperature of the period.

The adult moths generally fly at dusk (at a temperature of at least +16 °C). Moth emergence is followed by mating and egg laying.

Each female moth lays approximately 50 eggs. The eggs are usually laid on the undersides of leaves but may also be deposited on shoots and sprouts, or even directly on non-tomentose young fruits. The incubation period varies from two weeks to a minimum of 5-6 days during summer.

After wandering over twigs and leaves in search of food for a certain period of time, the newly hatched larvae enter tender new twigs at the shoot axil and then gradually work their way down the shoots.

Before reaching maturity, the larvae damage many different twigs leaving them as they harden for others. Then they seek a protected place on the trunk or on the ground around the base of the tree in which to spin a cocoon.

Later generation OFM larvae also feed on twigs and then enter the fruit as the twigs harden or attack the fruit directly particularly late in the season.

The larvae usually enter the fruit at the side or via the stem.

Once a larva has entered a fruit, it either bores a long irregular channel through the soft tissue down to the seeds or confines its activity to a small area of the tissue.

More than one larva may feed on the same fruit.

- Control of the Oriental fruit moth by mating disruption may be compromised by migration

The migration of Oriental fruit moths can seriously compromise controls achieved using mating disruption techniques.

Unlike female Codling moths, OFM females will readily move up to 200 metres from their source and evidence suggests that at least small numbers move 2 or 3 kilometres. Movement is in an upwind direction, following odour trails and is more pronounced toward the end of the season.

- Female moths release pheromones which attract the males of the species



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Male moths locate females by flying upwind, criss-crossing over the trails of pheromone produced by the females.

- Functioning of Isomate® OFM Rosso dispensers with regard to the oriental fruit moth

The output of each Isomate® OFM Rosso dispenser is equivalent to 20,000 virgin female moths at the calling period. In the presence of Isomate® OFM Rosso, the sensors on the antennae of male Oriental fruit moths are overloaded and the male moths lose their capacity to locate females.

If the number of female moths in the orchard is low, the false scent trails produced by the synthetic pheromone released into the air simply “distract” the male moths and prevent them from locating the females. Thus no mating occurs and the number of fertile eggs laid is dramatically reduced.

If the number of female moths is high, some males may find females, but mating is delayed.

Thus fewer fertile eggs are laid and the chances of successful control of the pest are improved.

If the number of moths in the orchard is enormous, sufficient chance meetings between males and females occur to allow a significant level of infestation.

- Isomate® OFM Rosso and Integrated Pest Management in the orchard

Isomate® OFM Rosso is the central component of an integrated program for peach orchards.

This dispenser can be used as the sole treatment for OFM, providing that the populations of moths are low and there is no immigration of mated females.

If OFM populations are very high, the use of the dispenser must be combined with some additional insecticide sprays in order to reduce the pest population pressure.

It is therefore vitally important to assess moth population density in the orchard in which the mating disruption technique is to be implemented prior to selecting the appropriate control strategy.

- In-season monitoring of the orchard

Mating disruption technique cannot be implemented in orchards without adequate monitoring during the entire growing season.



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Indeed, **careful and constant monitoring of the orchard** during the season in progress is fundamental. During the development of the larvae of the first OFM generation, monitoring should focus on controlling infestation levels on twigs and sprouts.

In peach orchards, at least 500 sprouts on 10 different trees (ca. 50 sprouts/tree) should be checked for damage. Samples should be chosen from the central area of the orchard and from the borders.

If damage exceeds the established threshold of 2-3 %, supplemental treatments may be needed.

In apple orchards, 500 sprouts on 10 different trees (ca. 50 sprouts/tree) or 500 fruits should be checked for damage. Samples should be chosen from the central area of the orchard and from the borders.

If damage exceeds the established threshold of 5 % on sprouts or 0.5 % on fruits, supplemental treatments may be needed.

Special attention should be paid to irregular orchards in which there are numerous gaps, orchards located in windy areas and orchards surrounded by herbaceous crops which provide no protection from the wind.

PRODUCT SPECIFICATION



Isomate® OFM Rosso twist-tie dispensers are supplied in vacuum packs of **400** units. Each brown-red polymer dispenser consists of two parallel tubes. The wire-filled tube is designed to ensure rigidity, while the other sealed tube is filled with pheromone. The dispensers are designed to be twisted around the branches of the trees.

In case of left-over stocks, unopened packages can easily be stored in cold storage facilities at temperatures below 10 °C (50 °F).



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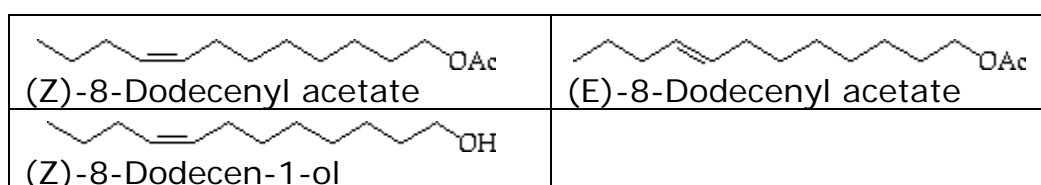
If cold storage occurs, dispensers must be kept at room temperature for at least one month prior to field application in the following season.

Application rate

600 dispensers per hectare (standard)*

* estimated rate which may vary according to orchard conditions

Chemical structure

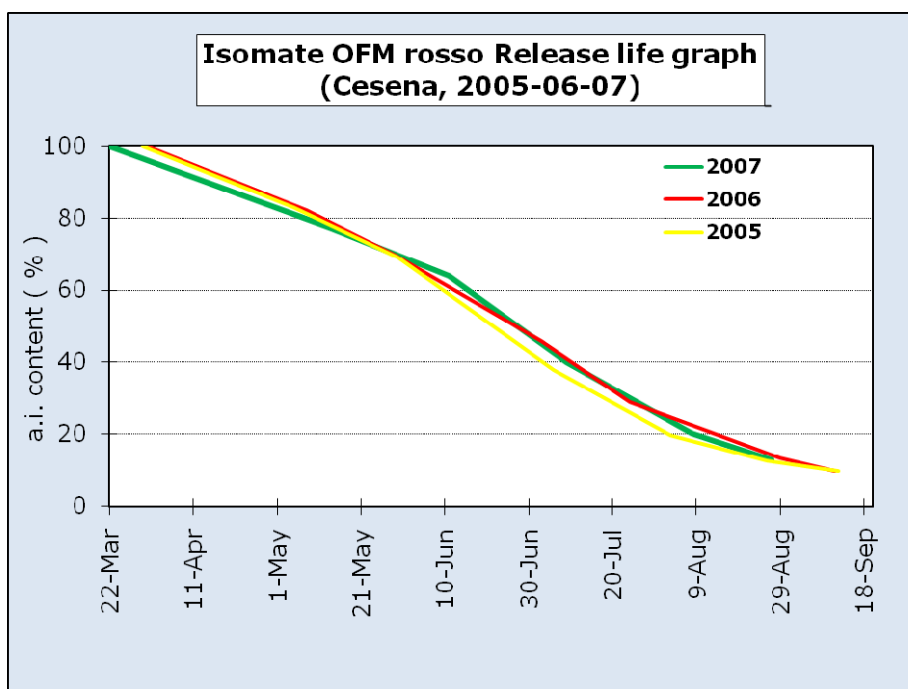


Nominal field life

Average dispenser release life is 160 to 180 days (**ALWAYS** depending on local daily mean temperatures and average daily wind velocity).

Early rather than late application is recommended.

Research data show that bringing the date of application of the dispenser forward by one month, only reduces the field life of the dispenser by a few days.





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PLANNING AN ISOMATE® OFM ROSSO IPM PROGRAMME

Aims

The aims of an IPM programme using mating disruption techniques are following:

- To prevent significant damage by Oriental fruit moth,
- To reduce the population of Oriental fruit moth or maintain it at a very low level.

If **no** migration of mated female moths from adjacent orchards occurs, the first of these aims is readily achievable during the first year of application, while the other can be reached over a number of years (at least two) of uninterrupted application.

- creation of orchard map

When various parts of the orchard in question are planted with different crops, it may be useful to prepare a rough map to help with the planning of the appropriate integrated program. Using the map, the orchard can then be divided into sections according to the crops grown (early, mid season and late peaches, plums, apricots, apples and pears).

- choice of treatments

If the orchard is isolated from others or surrounded by many kilometres of crops which do not support OFM (e.g. grapes), it is possible to achieve excellent control levels using Isomate® OFM Rosso.

All the sources of OFM within the property of reference – including small sections of plums, apricots, pears and apples – should be treated with Isomate® OFM Rosso.

Choosing the proper insecticide

The use of active ingredients with low impact on “beneficial insects” is recommended.

An example of the proper use and timing of application for some of these active ingredients is reported in the following table:



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Cydia molesta

Following AIs should be applied after the thresholds of 30 adults/trap/week (first generation) and of 10 adults/trap/week (later generations) have been exceeded

Larvicides

BACTERIA	Characteristics	Notes
<i>Bacillus thuringiensis</i>	Microbial insecticide acting by ingestion. When a susceptible insect ingests Bt, the protein toxin is activated by alkaline conditions and enzyme activity in the insect's gut. The toxicity of the activated toxin is dependent on the presence of specific receptor sites on the insect's gut wall. If the activated toxin attaches to receptor sites, it paralyzes and destroys the cells of the insect's gut wall, allowing the gut contents to enter the insect's body cavity and bloodstream.	<i>Bacillus</i> -based products must be applied close to egg-hatching in such a way that the crystal proteins are swallowed by the newly hatched larvae. Persistence: 7-10 days.
MAC	Characteristics	Notes
Metoxyfenozide	Insecticidal ecdysteroid agonist that causes insect larvae to moult prematurely and die (Moulting Accelerating Compound).	This insect growth regulator has no ovicide efficacy. Therefore it must be applied at the end of embryonic development or on newly hatched larvae. Persistence: 21 days.
NEONICOTINOIDS	Characteristics	Notes
Thiacloprid	It disrupts the nervous system by acting as an inhibitor at nicotinic acetylcholine receptors.	Efficacy on eggs and on larvae (L1 age).
OXADIAZINE	Characteristics	Notes
Indoxacarb	Indoxacarb possesses ovi-larvicidal activity. Larval mortality is caused by exposure of the neonates to the residues deposited on the outer egg surface, from ingestion of the treated egg membrane or corion, during egg hatch.	Low ovicide efficacy. Therefore it must be applied at the end of embryonic development or on newly hatched larvae. The best application timing is beginning of oviposition and black head stage.
NON-ESTHER PYRETHROID	Characteristics	Notes
Etofenprox	Etofenprox acts on the nervous system of insects disturbing the function of neurons by interaction with the sodium channel.	It has insecticide activity by contact and ingestion, has a broad spectrum of action on a wide variety of pests, with fast knockdown
SPYNOSIN	Characteristics	Notes
Spinosad	Spinosad acts on the post-synaptic nicotinic acetylcholine (Ach) and γ -aminobutyric acid (GABA) receptors, resulting in tremors, paralysis, and death of the target insects.	The product acts principally on larvae both by contact and ingestion. It is used at the end of embryonic development or on newly hatched larvae.
AVERMECTINE	Characteristics	Notes
Emamectin benzoate	The mode of action is similar to abamectin (GABA - and glutamate-gated chloride channel agonist), Emamectin benzoate acts by stimulating the release of γ -aminobutyric acid, an inhibitory neurotransmitter, thus finally activating chloride channels. The target insect stop feeding within hours of ingestion, and die 2-4 day.	It possesses larvicidal activity by contact and ingestion. The optimal application timing ranges from pre-hatching egg to larvae late stage (L ₄ -L ₅).



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RYANODIN	Characteristics	Notes
Rynaxypyr (Chlorantraniliprole)	Rynaxypyr's mode of action is activation of insect "ryanodine receptors" (RyRs), which stimulates the release of calcium from internal stores of smooth and striated muscle, causing impaired muscle regulation, paralysis, and finally death.	Rynaxypyr possesses ovi-larvicidal activity. Ovicidal activity consist in either killing the embryo or the completely developed larvae inside the egg, such that the egg membrane remains intact and the individual does not hatch. Larval mortality is caused by exposure of the neonates to the residues deposited on the outer egg surface, from ingestion of the treated egg membrane or corion, during egg hatch.
PYRETHROIDS	Characteristics	Notes
Acrinathrin	Acrinathrin affects both the peripheral and central nervous system of the insect. It works by keeping open the sodium channels in neuronal membranes. It disrupts the normal functioning of nerve sodium channels, leading to hyperactivity, paralysis and death. Acrinathrin provides excellent knock-down efficacy and good residual activity (2-3 weeks).	It acts by contact and stomach action. It shows strong activity on adults and newborn larvae.
ORGANOPHOSPHATES	Characteristics	Notes
Clorpirifos etile	Organophosphates interfere with acetylcholine-mediated synaptic transmission in the nervous systems inhibiting the enzyme acetylcholinesterase (AChE) resulting in acute cholinergic over-stimulation at nicotinic and muscarinic synapses of the peripheral, autonomic and central nervous systems.	Organophosphates must be applied at the end of embryonic development or on newly hatched larvae. Some of these products are able to destroy larvae even in the first subepidermal strata of the fruit
Clorpirifos metile		
Phosmet		

N.B.: In the application of various products, carefully follow the instructions and warnings on the label provided by the manufacturers.

Some a.i. may not be authorized in some IPM programs, therefore refer to local IPM Guidelines



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Side-effects of some pesticides on natural enemies

IOBCwprs Working Group "Pesticides and Beneficial Organisms & IOBCwprs Commission "IP Guidelines and Endorsement" (05.12.2005 Comm.)	Type	Classification of side effects to beneficial organisms															
		<p>N = harmless or slightly harmful (Reduction field, semi-field 0-50%, lab 0-30%) M = moderately harmful (Reduction field, semi-field 50-75%, lab 30-79%) T = harmful (Reduction field, semi-field > 75%, lab >80%) Normal black entries = laboratory data (IOBC) Bold black face = semi-field test data (IOBC) Asterix * marked black entries = Field test data (IOBC)</p>															
Active ingredients	I = Insecticide A = Acaricide	Predatory mites (Typhlodromus pyri)	Predatory mites (Phytoseiulus persimilis)	Spiders (Pardosa spp.)	Spiders (Cheiracanthium mildei)	Flower bugs (Anthocoris nemoralis)	Flower bugs (Orius laevigatus)	Lacewings (Chrysoperla carnea)	Lady bird beetles (Coccinella 7-punctata)	Rove beetles (Aleochara bilineata)	Ground beetles (Poecilus cupreus)	Parasitoids (Aphidius rhopalosiphi)	Parasitoids (Trichogramma cacoeciae)	Hoverflies (Syrphus corollae)	Toxicity to bees	Toxicity to earthworms (Eisenia foetida)	Fish toxicity
Azadirachtine	I	N	T			T	N	M	N		N	M	T	M	-		
BT var. kurstaki	I	N*	N			M		N	N	N	N		N		-		-
Buprofezin	I	N	N		N	N		N	N	N			N		-		+
Chlorpyrifos-ethyl	I	T	T	T	T	M		T	M	T			T	T	+	+	+
Chlorpyrifos-methyl	I	M-T				M		T	N				T		+		+
Diflubenzuron (IGR)	I	N*	N		T	N	M	T	N-M	N			N		-	-	-
Fenoxycarb (IGR)	I	N*	N		N	N*	M	M	N	N		M	N		+		+
Flufenoxuron (IGR)	I	N*	N			M		M*		T	N						
Granulosis-Virus	I	Selective method of control without influence on beneficial arthropods															
Imidacloprid	I	N*	T			T	T	M	T		N	T	T		+	(-)	(-)
Indoxacarb	I	N				M		N	M	N			M	N	-	-	+
Lufenuron	I	N*	N			N	M	T	T			M	M		-		-
Methoxyfenozide (IGR)	I	N				N		N					N		-		-
Phosmet	I	T*	T					N*	M	N			T				
Pirimicarb	I	N				N		N	N				M	M	-	-	-
Rotenone	I	M				M		M					M		-		+
Spinosad	I	N*	N				N	N	N				M		+		-
Tebufenozide (IGR)	I	N*	N			N	N	N	N		N	N	N		-		
Teflubenzuron (IGR)	I	N				N		N	T				N	N	-		-
Thiacloprid	I	N		M					T	N	M	T			-		+
Triflumuron	I							T*							-		
Abamectine	A	N-T	T				T	N	N			T	T		+		+
Clofentezine	A	N*	N		N	N*		N	N	N			N	N	-		-
Etoxazolo	A	M						M					N		-		+
Hexithiazox	A	N*	N		N	N*		N	N	N			N		-		-
Fenazaquin	A	M				M									-		+
Fenpyroximate	A	N-M	T			N-M	N	N	T	N	N	T	M		-		+
Spirodiclofen	A	N-M				M		N	M				N	N	+		-
Tebufenpyrad	A	M*	T			T	N	N	N		N	T	T	M	-		+



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TIMING AND METHOD OF APPLICATION OF ISOMATE® OFM ROSSO IN ORCHARDS

Timing of application

Isomate® OFM Rosso dispensers **must** be applied before the first flight of OFM in spring, that is before biofix i.e. the first catch in monitoring traps (approximately at petal fall as far as peach trees are concerned).

Location of dispensers

Dispensers should be located in the upper third of the canopy.

Supplementary dispensers on border rows should be placed near tree tops.

Application rate

600 dispensers per hectare (standard)*

* estimated rate which may vary according to orchard conditions

Control of application scheme

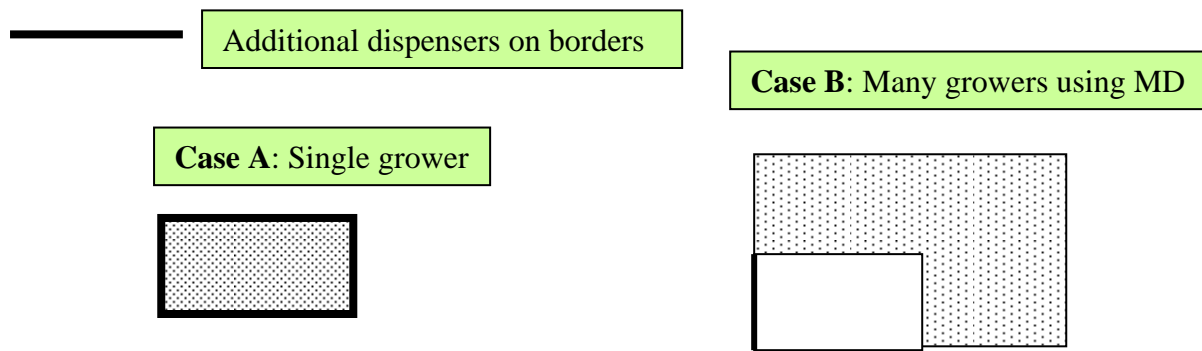
In order to establish the application scheme it is important:

- 1) To know the overall surface of the orchard in such a way as to be able to assess the total number of dispensers required. Once the number has been calculated, a further 5% should be added (according to the size of the orchard) for additional applications in border rows.
- 2) To know the total number of plants per hectare (calculated on the basis of plant spacing).
- 3) To apply dispensers uniformly throughout the entire orchard according to the recommended application rate that, in the case of OFM, is 600 dispensers per hectare.
- 4) To place dispensers according to the application diagram without reducing application rate. Any left-over dispensers should be used in hot spots of the orchards and windy areas (edges, high spots) in which pheromone concentration may be reduced. Download our dosage calculation software from www.cbceurope.it/biocontrol
- 5) To cooperate with neighbours for an area-wide approach



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Oriental fruit moths do not respect fences and can move considerable distances (up to 2–3 km). Thus the migration of mated females from adjacent orchards can be a serious problem. The best way to beat this pest is to cooperate with neighbours in such a way as to manage OFM using mating disruption techniques throughout a wide area. This not only increases the chances of success of the method, it also reduces the total amount of materials needed.



Method of application

Dispensers should be applied on lateral branches without twisting them too tightly in order to avoid cracking their surface and thus compromising the quality of the pheromone emission.

Avoid applying dispensers as shown in following pictures

