

**Codling moth (*Cydia pomonella*)**



Codling moth is the key pest of pipfruit as it targets the fruit directly and has the potential to damage a large proportion of the crop in untreated situations. Codling moth prefer apples, but also attack pears and walnuts.

Codling moth live over winter as a fifth instar larvae in a cocoon under bark, in cracks or in dry detritus under the tree. Potentially there are enough larvae pupating and emerging as adults to inflict significant fruit damage.

In Hawkes Bay, the larva pupates in its cocoon and adults begin to emerge in early to mid-October. Peak emergence is in early to mid-December with maximum flight activity from mid December until mid February. Pheromone traps are a cheap and reliable method for monitoring adult activity.

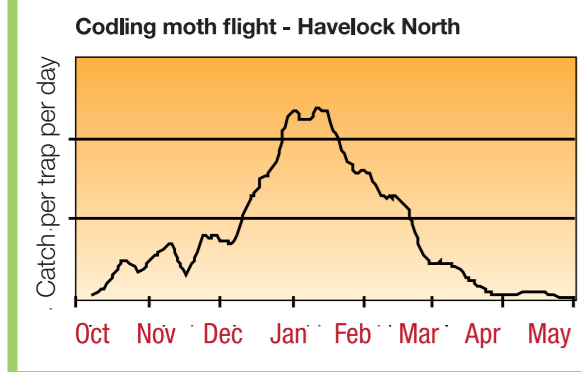
Typically there is only one extended generation in Hawkes Bay, but some individuals will not diapause and emerge in late summer to mate and lay a second generation of eggs/larvae. Few of these second-generation larvae complete development before the fruit are harvested.

**Biological factors**

Males locate females using sensitive receptors on their antenna which detect small amounts of pheromone released by the female. When males detect pheromone they will often start wing fanning to draw more air over their antennae. If more pheromone is detected they often start to fly up-wind in a zig-zag fashion keeping the signal as strong as possible, until they locate the female and mate. Moths can mate more than once.

For Codling moth and Leafrollers, female calling and mating only occur for a couple of hours after dusk and on rare occasions just prior to dawn. Codling moth do not fly in temperatures below 12°C and for leafrollers the threshold is 8°C. Moths do not fly in windy conditions, although localised flying may be possible within the shelter of the trees.

Mating disruption is the preferred and most cost-effective method for controlling Codling moth on organic orchards in the Hawke's Bay. In most cases it will be the only Codling moth treatment required and has revolutionised organic pipfruit production.



**Light Brown Apple Moth (*Epiphyas postvittana*)**



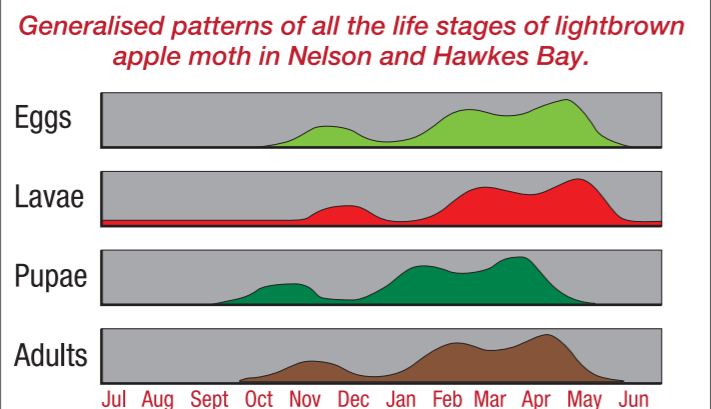
Light brown apple (LBAM) is a major pest species in all pipfruit regions of New Zealand. Its range of hosts is extremely large, with the more common hosts being apples, pears, citrus varieties, black and red currants, kiwifruit, hops, red and white clovers etc.

In southern areas with two generations per year, emergence begins in early November and is spread over December and most of January. Males emerge a short time ahead of females. The second generation emerges from February to May. In northern areas, the emergence of the over-wintered generation is completed by December, the second generation of adults occurs over January/early March, and overlapping with the third or partial third generation occurs in March to June.

Female lightbrown apple moth produce a potent sex pheromone which gives long range communication with males seeking a mate. The pheromone is released in the evening, particularly around dusk, and attracts males over long distances. Females are normally mated only once and egg laying usually begins on the following day (range 1-7 days later) and reaches a peak after 2-3 days. The female lays a series of egg batches almost exclusively on the upper leaf surface of host plant over a period of up to three weeks.

Surface fruit damage is common in short-stemmed apple varieties which form compact fruit clusters. Leaves are webbed to the fruit and feeding injury takes place under the protection of the leaf; or larvae spin up between fruits of a cluster.

Mating disruption for lightbrown apple moth control is recommended at a minimum application rate of 600 dispensers per hectare. For effective mating disruption, dispensers should be placed as high as possible in the trees (ie. in the top ¼ of the canopy), sheltered from the sun. Extra dispensers are advisable in place of missing trees or around gaps in the foliage canopy, or around block borders. The canopy is important in keeping the pheromone cloud in the orchard. Mating disruption is most effective on large areas (minimum 2 ha). This minimises edge effects where the pheromone cloud breaks down, and where mated females may fly into the orchard from outside. Wind breaks up the pheromone cloud and shelter belts can be valuable in reducing this problem.



**Codling moth**

(*Cydia pomonella*)



**When to apply:** As as prescribed by a fruit export protocol in early October in North Island regions, and late October in lower South Island regions.

**Rate:** Use 1000 dispensers per ha Isomate C plus. For Isomate CTT use 500 per ha

**Oriental fruit moth**

(*Grapholita molesta*)



**When to apply:** As prescribed by a fruit export protocol or in Mid-Late September

**Rate:** Use 500 dispensers per ha

**Light Brown Apple moth**

(*Epiphyas postvittana*)



**When to apply:** Full-bloom or early October

**Rate:** Use 600-1000 dispensers per ha

**Experimental Isomates; Field testing still in progress.**

**Citrus Flower Moth (CFM).** (*Prays nephelomima*)

Rate; Use 1000 dispensers per ha

**Three NZ leafroller (3LR).**

Lightbrown moth (*Epiphyas postvittana*), Green headed leafroller (*Planotortrix octo*), and Brown headed leafroller (*Ctenopseustis obliquana*)

Rate; Use 600 to 1000 dispensers per ha.

Number of Dispensers per Hectare			
Number of dispensers/Hectare	500	600	1000
<b>Isomate Type</b>	 	 	   
Trees/ha 500	1 dispenser/ 1 tree	6 dispensers/ 5 trees	2 dispensers/ 1 tree
600	5 dispensers/ 6 trees	1 dispenser/ 1 tree	5 dispensers/ 3 trees
700	2 dispensers/ 3 trees	5 dispensers/ 6 trees	7 dispensers/ 5 trees
800	3 dispensers/ 5 trees	3 dispensers/ 4 trees	5 dispensers/ 4 trees
900	5 dispensers/ 9 trees	2 dispensers/ 3 trees	10 dispensers/ 9 trees
1000	1 dispenser/ 2 trees	3 dispensers/ 5 trees	1 dispenser/ 1 tree
1200	2 dispensers/ 5 trees	1 dispenser/ 2 trees	5 dispensers/ 6 trees
1400	1 dispenser/ 3 trees	3 dispensers/ 7 trees	2 dispensers/ 3 trees
1600	3 dispenser/ 10 trees	3 dispensers/ 8 trees	3 dispensers/ 5 trees
1800	2 dispensers/ 7 trees	1 dispenser/ 3 trees	4 dispensers/ 5 trees
2000	1 dispenser/ 4 trees	3 dispensers/ 10 trees	1 dispenser/ 2 trees
2200	2 dispensers/ 9 trees	3 dispensers/ 11 trees	5 dispensers/ 11 trees
2400	1 dispenser/ 5 trees	1 dispenser/ 4 trees	2 dispensers/ 5 trees
2600	2 dispensers/ 11 trees	3 dispensers/ 13 trees	5 dispensers/ 13 trees
2800	2 dispensers/ 11 trees	3 dispensers/ 14 trees	5 dispensers/ 14 trees
3000	1 dispenser/ 6 trees	1 dispenser/ 5 trees	1 dispenser/ 3 trees

*NB Important that dispensers are spread evenly throughout treated blocks if spares put extras on boundaries especially windier edges of orchard*

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NoMate is a registered trademark of Scentry USA.



**Trusted Mates.....**

**Isomates®**

**IFP and Organic pest management**

*Through the tough times and the good times there are some mates you can trust.....*

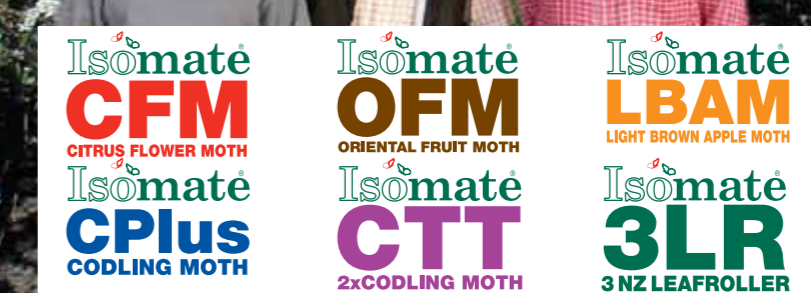


**ISOMATES**

- Widely tested and proven in NZ by Plant and Food Research
- Ideal for IFP, Apple Futures and Organic Orchards
- Environmentally friendly
- Targets specific insect species
- Optimum release pattern
- Easy to apply and handle
- One application per season
- Lasts for 5-6 months



**The trusted GOLD STANDARD for mating disruption**



# Isomate®

## IFP and Organic pest management

Isomate mating disruption dispensers are an environmentally friendly method of insect pest management for use in IFP, Apple Futures and organic orchards.

### How to use Isomate's

#### Placement of dispensers

Dispensers should be put out just before the first moths emerge. In Hawke's Bay, this occurs in early October for CM, and in mid-late September for OFM (check packet label for details). The recommended dispenser rate per hectare is 1000 for CM and 500 for OFM and they last for 5-6 months, depending on temperature. The correct placement of dispensers is crucial to the success of mating disruption.



- They need to be attached to the top 10% of the tree.
- Dispensers must be placed individually in each tree. If trees require two dispensers, place on opposite sides of the tree. It is essential to have an even spread of pheromone dispensers throughout the whole block.
- Bend the dispenser around a branch and use one twist to loosely attach them.
- Dispensers should be placed in a shady position (i.e. on the southern side of the tree). This will help to prevent the pheromone evaporating too quickly and will extend dispenser life.

- If moths are likely to be immigrating from a neighbouring block, put extra dispensers in the boundary trees, shelter or fence line.
- If treated blocks are subjected to strong winds, place more dispensers on the windy side.

#### Monitoring the effectiveness of dispensers

Organic orchards that already have an internal population of CM or OFM need a strategy to detect if additional treatment is required. Standard pheromone traps and placement will not catch moths within a mating disruption environment. Insects in disrupted orchards can be monitored by:

- Using traps baited with 10x concentrate Desire pheromone lures
- Place traps in the block following IFP guidelines (one trap per 1-2 ha, biased towards areas with immigration pressure)
- Placing traps at the tops of trees (this is where disruption is most likely to be less effective), using a rope-pulley system or poles
- Checking and clearing traps weekly and keeping them well maintained (change bases 3 weekly and lures 6 weekly)
- Using the IFP pest thresholds to determine when to apply Codling moth granulosis virus.



Monitoring with DESIRE Traps and Lures

### Getting the best out of Isomate disruption.

**Release Pattern:** Use a dispenser tested and proven under NZ conditions. Dispenser release technology varies by product. Even release throughout the season and particularly late season is critical to protect the crop. Some competing products can release too fast meaning less protection late season, some too slow meaning lower concentrations are released in season.

**Pest population:** Mating disruption is most effective on low to moderate pest populations. Implement mating disruption before the pest becomes a problem, otherwise use mating disruption with insecticides, at least during the first season.

**Block size and shape:** Pheromone treated areas should be a minimum of 2 ha. Mating disruption does not prevent females mating outside the treated area and then flying in and laying eggs. Therefore, it works best on larger blocks because a bigger area, away from the edges, can be protected.

**Square shaped blocks are preferable to long thin ones:** More of the trees are some distance from the boundaries and therefore less vulnerable to immigration of mated females.

**Flat blocks are preferable to sloping ones:** The pheromone will drain away with air movement down slopes.

**A uniform block with larger trees is better than one with many small or missing trees:** Leaves not only reduce wind speed, they also act as small pheromone dispensers by absorbing and re-releasing the pheromone. An even canopy has fewer gaps and provides a more uniform pheromone concentration.

**Wind:** High winds dilute the concentration of pheromone in the orchard. Dispensers are placed in the tops of trees as this is where moths often mate and wind downdrafts push the pheromone downwards.

**Blocks should have good shelter:** Wind can reduce pheromone concentrations below effective levels in exposed blocks.

**Hill sites also present a problem,** as wind speeds are greater over the tops of hills.



Isomate  
**CFM**  
CITRUS FLOWER MOTH

Isomate  
**CPlus**  
CODLING MOTH

Isomate  
**OFM**  
ORIENTAL FRUIT MOTH

Isomate  
**CTT**  
2x CODLING MOTH

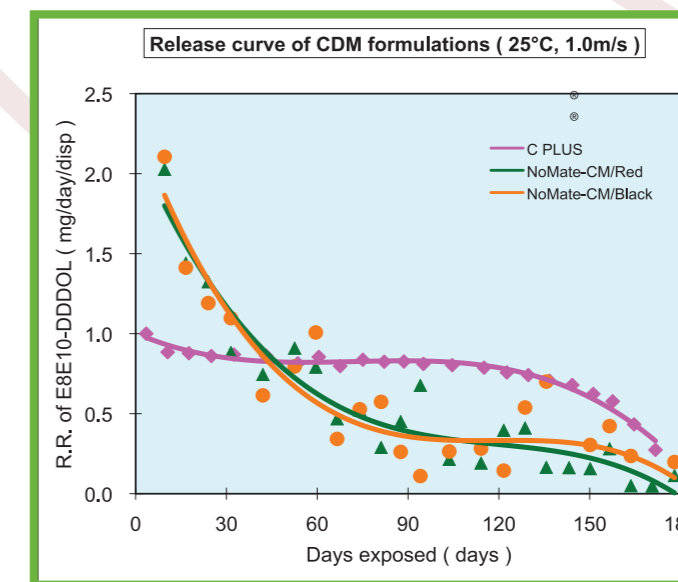
Isomate  
**LBAM**  
LIGHT BROWN APPLE MOTH

Isomate  
**3LR**  
3 NZ LEAFROLLER



#### THE TWO KEYS TO EFFECTIVE MATING DISRUPTION:

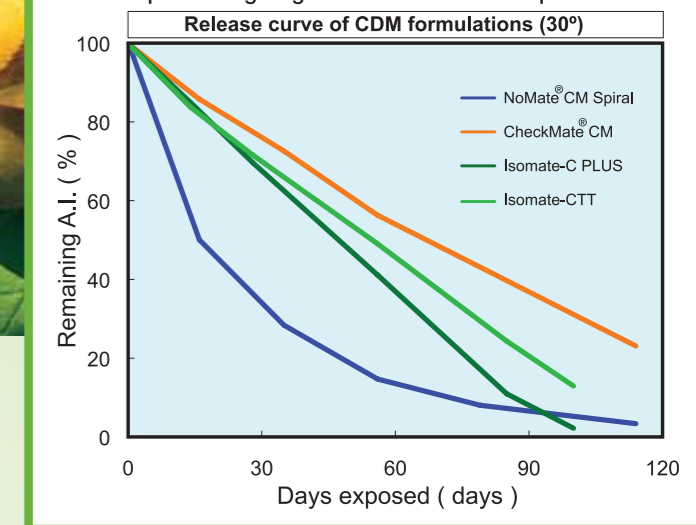
1. Even release of the pheromone from the dispenser to ensure season long performance - in the local climate. This is more critical in NZ where pest thresholds are so low compared with many overseas situations where large domestic markets eg USA, Australia can accept a level of pest damage. Fast release will result in lower concentrations of pheromones and less protection in late season. Slow release will result in significant amounts of pheromone left in the dispenser after harvest, but with a lower concentration of pheromone and hence less protection during the season. Shinetsu Japan have run a series of controlled studies to compare Isomates with some competitor products (see tables following).
2. Local testing. Plant & Food Research (formerly Hort Research) have spent over a decade testing and proving Isomate products. Release patterns differ with temperature and so what may work in a hot dry environment with little wind run overseas may not perform the same in NZ. Isomate products have been exhaustively tested and proven in NZ for NZ growers.



Isomate C Plus demonstrates even pheromone release over 4 to 5 months at 25 degrees celsius.

(Source: Shinetsu Japan)

An accelerated study at 30 degrees C demonstrates Isomate products giving the most even release patterns.



#### Oriental fruit moth (*Grapholita molesta*)

Oriental fruit moth (OFM) is a key pest of summerfruit as it targets the fruit directly and has the potential to damage a large proportion of the crop in untreated situations. OFM also attacks apples, pears and quince. OFM has 3-4 generations in New Zealand (see graph). In September the caterpillars complete their development and begin to emerge as moths. Little or no emergence occurs below 10°C and adults generally do not fly until temperatures rise above 15°C. The moths mate within 1-2 days of emerging and in spring there is a delay of several days between mating and egg-laying. The eggs take about 8 days to hatch in spring, but only 3-4 days in summer. In autumn newly hatched larvae of the first two generations wander on to the outside of the shoot for only a few hours before tunnelling into a shoot tip. The attacked shoots die back at the tip, which is often the first sign of infestation. Each caterpillar uses several shoots to complete its development. Fruit of early varieties can become infested from late October onwards and all fruit are increasingly attacked as the season progresses. For effective mating disruption, 500 OFM dispensers should be placed as high as possible in the trees sheltered from the sun.

Generalised pattern of OFM trap catches in Hawke's Bay, showing three increasing peaks during the growing season

