

New Codling Moth Insecticides

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Several new insecticides have recently been registered for codling moth (CM) control on apples. Others are pending registration in the near future. Many of the new materials are “reduced risk” products that the EPA considers safer for people. These new materials also have different chemistries than our traditional organophosphate (OP) materials (Guthion and Imidan). This means that they should be helpful in preventing or slowing the development of OP resistant codling moth populations. One of the keys to preventing the development of resistance to any material is to alternate it with materials of different chemistries. We also need to understand how these new chemistries work against codling moth so we can use them most effectively.

Over the past few years, Dr. Bob Van Steenwyk, Extension Entomologist at UCB, and I have been conducting small scale field trials of the unregistered and newly registered codling moth materials to see how they perform on apples in Brentwood. Most of the trial have been conducted in cooperation with Richard Chavez and Ron Nunn. The following is a summary of the more promising materials.

Neonicotinyls

These are reduced risk, contact materials that have a narrower spectrum of activity than OPs. Assail and Calypso have recently been registered for CM control. In order to prevent the development of resistant populations, it would be wise to limit your application of all neonicotinyls to a single generation/season. This includes Provado which is also a neonicotinyl used for aphid and leafhopper control but isn't effective against CM.

- **Assail** was registered in California in 2003. It is a lower toxicity material (Category III) with a 12 hour re-entry interval (REI) and a 7 day pre-harvest interval (PHI). It is toxic to both CM eggs and larva and is similar in effectiveness to Imidan. It should be applied at the traditional 250 DD timing (early egg hatch) just like the OPs and reapplied in 14 days if the flight is prolonged. There is a limit of 4 applications per season. This material can be hard on mite predators. The addition of oil (1% v/v) will boost CM effectiveness and help to reduce mite flare-ups. This material is also effective against leafhoppers and the green apple aphid complex. It has less activity against woolly and rosy apple aphids and is not effective against leafrollers.
- **Calypso** was registered in California in September of 2005. Our tests have shown this to be similar to Assail in effectiveness against CM. Like Assail, it is toxic to both the eggs and larva and should be applied at the traditional 250

DD timing (early egg hatch) and reapplied in 14 days if the flight is prolonged. There is a 12 hour REI like Assail but the Calypso label is more restrictive in other areas – it is a Category II material with a 30 day PHI, a 100 foot buffer restriction for aerial applications near waterways, and a maximum of 2 applications/season. The addition of 1% oil will improve CM efficacy and reduce the likelihood of mite flare-ups. This material is more effective against rosy apple aphid than Assail and similarly effective against leafhoppers and green apple aphids. It is not effective against woolly apple aphids or leafrollers.

Insect Growth Regulators

These materials do not kill on contact but must be absorbed through the egg or eaten by the larva and they eventually kill the pest by preventing normal development. Feeding usually stops pretty quickly even if it takes awhile to kill the pest.

- **Intrepid** was registered in California in May of 2003. This material is active against the larval stage and should be applied just prior to the beginning of egg hatch (100-200 DD). It must be eaten by the larva to be effective so timing and thorough spray coverage are critical. It should be re-applied in 10-18 days if the flight continues. It is only moderately effective against CM in the field and is best used in a low pressure site or in conjunction with mating disruption. It is a low toxicity product (Category III) with a 4 hour REI and a 14 day PHI. No more than 64 oz (4 applications) can be applied per season. It also has some activity against leafroller pests but has little known effect on other secondary insects or beneficials. Be aware that if you have a Guthion resistant codling moth population, they may be resistant to this material too (even though it is in a different chemical classification).
- **Rimon** was registered on apples in California on late 2006. Our small scale field trials here have shown this to be a very good CM material. It is a benzoyl urea material like Dimlin but it is more active than Dimlin against CM. It is only effective against the egg stage and it must be applied at the very beginning of the egg laying period (50-75DD) so that the eggs are laid on top of the residue. The label recommends reapplication at 14-17 day intervals if flight continues although tests in Washington have indicated that it may be effective for up to 1 month. It can sometimes be difficult to get an application on before the flight starts due to weather and the inherent inaccuracies of degree day calculations, but it can be mixed with a low rate of a good contact material (ie. Assail, Warrior, Battalion) for application after the flight has begun. Be aware that if you have a Guthion resistant codling moth population, they may be resistant to Rimon too (even though it is in a different chemical classification). It can be toxic to bees and waterways so take proper precautions. It may also have some effect against leafminers, leafrollers, and leaf hoppers but is pretty safe for beneficial insects.

Spinosyns

These are a new class of insecticides derived from a naturally occurring soil micro-organism. These materials are not contact materials and need to be eaten by the larva to be effective.

- **Success** and **Entrust** are low toxicity materials (Category III) with a 4 hour REI and a 7 day PHI. Entrust received a CA registration in the spring of 2006 and is the organic formulation of Success which received a CA registration in the fall of 2004. Both can be expected to perform similarly. Both are only mild codling moth materials best used in low pressure sites or in conjunction with mating disruption. They should be re-applied at 10 day intervals if flights are prolonged. Efficacy can be improved with the addition of 1% oil. Entrust can be an important component of an organic production system but there are better CM options available for conventional growers. They are both very effective against leafrollers and can have good activity against leafminers and thrips. As thrips can be good mite predators (as well as an apple pest itself) you may see an increase in mites if the thrips have been helping to control them in your orchard. To prevent the development of resistance, only 3-4 applications (depending on your rate) can be applied per season.

- **Delegate** is a new Dow AgroSciences material that is not yet registered but it is hoped that it will have a CA registration by the 2008 season. It is a reduced risk material that is closely related to Success/Entrust but is much more active against codling moth (and thrips) than either of these two. It must be consumed by the larvae to be effective so good application and timing are important. In our small scale CA field trials this material has performed as well as our Guthion/Imidan standard. It is not quite as long lived as Guthion but it looks to be one of the best reduced risk materials for codling moth control coming down the road.

Pyrethroids

These are traditional, broad spectrum, contact materials. As a class they tend to have lower mammalian toxicities than organophosphates but can be hard on beneficial insects which can result in secondary pest outbreaks. They also have the potential to contaminate waterways through sediments in orchard runoff or through drift. These are not considered the most environmentally friendly products but they can be very useful if used selectively when softer materials won't do the job.

- **Warrior** has been registered on a number of crops in CA since April of 2002. It is a Category II material with a 24 hour REI and a 21 day PHI. In our CA field trials it has performed as well as Imidan to control CM. It also has activity against a wide range of other pests including leafrollers, leaf miner, leaf hoppers, apple maggot, plant bugs, green and rosy apple aphids, and San Jose scale. However, to prevent the development of resistance, don't use this material on all these pests in one season – alternate

with non-pyrethroid materials. There is a seasonal limit of 20.5 oz/A which is 4 - 8 applications (depending on your rate). Watch for mites and other secondary pests. The addition of oil can help to reduce mite problems. This is a good contact material to add to the tank when a little extra control is needed.

Other Classifications

- **Altacor (rynaxypyr)** is a new Dupont product that is expected to be registered by the 2008 season. It is a reduced risk material with a novel mode of action that should help with resistance management. It must be consumed by the larvae to be effective so good application and timing are important. It is quite safe for people, the environment, and most natural enemies. In our small scale CA field trials this material has performed as well as our Guthion/Imidan standard. It is probably not quite as long lived as Guthion but it looks to be as good as Delegate and one of the best reduced risk materials for codling moth control coming down the road.

- **Cyd-X** received a California registration in April of 2006. This is one of 3 microbial insecticides using codling moth granulosis virus as the active ingredient. The other two materials (Carpoviroline and Virosoft) have been shown to be equally virulent but they are not yet registered in California. Cyd-X is an organically approved product with a very low toxicity rating (Category IV), a 4 hour REI, and no PHI. It must be eaten by the young larva to be effective. It can take a few (to several) days for the larva to die so damage may be evident in the fruit. However, the NEXT generation flight and damage should be reduced. It is a short lived product and needs to be reapplied at least weekly beginning at hatch (160-200 degree days) and continuing as long as significant flight has occurred the week before. The addition of oil may improve efficacy and allow the reapplication interval to be stretched a bit. Because of the slow kill and short field life this is considered a mild codling moth material that is best used in low pressure sites or as a supplement to mating disruption. It is an important component in an organic program and may be used with other insecticides in a conventional program to reduce subsequent generations. The concentrate should be stored in the refrigerator or freezer to extend shelf life and mixed with non-chlorinated water with a neutral pH (7.0) in the spray tank. It is only effective against CM and has no known effects on beneficial insects or other pests.