Codling Moth Control Research and Observations

by

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Codling Moth Control in Utah orchards continues to be a difficult task for the fruit grower. Several years ago it was found that some codling moth had acquired resistance to "guthion" and recurrent areas of resistance have been found. After spending several years investigating how we could deal with, and control the resistance factor in CM populations, it is now apparent that, we will loose the ability to use "guthion" by 2005 because it will not be registered for this use. The only other effective organo-phosphate material available is Imidan and the status, cost and effectiveness of this material are all in question. Anticipation of this 'fluid' state of the CM control program has led us to assess other potential control strategies. The following "observations" have been made and are set forth here to help understand the 'proposed control strategy' that follows.

Mating Disruption in Controlling Codling Moth Populations:

For 10 years we have been using Mating Disruption (MD) in CM control programs in Utah, Idaho, and Washington. It has developed into an effective tool, but in most cases it can not be considered a 'stand alone' strategy. To achieve the greatest possible effect the grower must:

1. Properly place, maintain, and monitor traps to determine the number and stage of development of the CM population in his orchard.
2. Precisely determine the "Bio Fix" point in his orchards and accumulate temperature data so the developmental stages of the CM population can be determined from available 'models'.
3. Scout the orchard frequently to find and asses the extent of any sting or worm problems that may develop.
4. Have at his disposal an effective 'chemical control strategy' to supplement the MD strategy when MD does not result in acceptable levels of control.

When we began to use MD in CM control the adult CM were still killed by the application of guthion, but over the past 10 years the effectiveness of guthion against the adult stage of this pest has decreased gradually, to the point that trap catches often do not drop following the application of guthion as a cover spray. Because the commonly used CM cover sprays do not kill the adults we have had to place the MD material in the orchard before the initial mating period begins at the "bio-fix" stage.

Because of the need to place the MD materials in the orchard at or before full bloom there are questions about how well these materials will last throughout the season. In warmer climates and at high altitudes the materials contained in the MD dispensers evaporate and diffuse more rapidly than at lower elevations and

cooler climates and hence deplete more rapidly. It has been our experience that during seasons when there is a partial 3rd generation such as 2002, there is not sufficient material left in the dispensers to effectively disrupt the mating process of that 3rd generation. In the orchards where the most successful use of this strategy has occurred we have used a second application of MD dispensers at a 50% rate at the beginning of the second generation.

Chemical Control of Codling Moth Populations:

In the mid 1990's resistance in the codling moth populations to guthion was identified in some locations in Utah County. By the second cover timing of 2001 some populations had achieved enough resistance so that the newly hatched larvae were able to survive and infect fruit as early as 7 to 10 days following the application the maximum legal rate of guthion. This necessitated the use of alternative materials. The following 3 materials are currently available and there are a number of others that are being tested. It appears that we will be able to use guthion during 2003 and 2004 and then we will need to rely on these alternatives.

1. Imidan – This material is an organo-phosphate which is related to guthion but has a shorter effective life and is somewhat more 'environmentally soft'. Because it is related to guthion there is an expectation that resistance to this material could develop quickly as we have seen many examples of "cross-resistance-development". Also, given the chemical nature of this material it enters into the "exposure-cup" and its continued registration for CM control is questionable. In addition to the above the residual of this material requires re-treatment at 12 to 14 day intervals and the amount of material needed per acre makes the treatments much more expensive.
2. Danitol – This material belongs to a class known as 'synthetic pyrethriods' which, as a class have generally not been 'favored' by researchers and growers. The reasons for this disfavor are varied but generally boil down to the fact that these materials are not selective and can have severe environmental impacts. Danitol has been used in several orchards in CM control programs when resistance problems arose.
   During June of 2001 this material was used in several blocks to control resistant codling moth. In some of these blocks several applications were made during the first generation and the first cover aimed at the 2nd generation. Observation showed the material to be highly effective with an effective period of 14 to 18 days. It was also noted that it killed all mites, including the predators in the trees.
   During 2002 we observed treated blocks very closely, concentrating on the effects of Danitol on predators in the trees and also in the cover crop. Close observation of blocks after treatment for the 1st cover revealed survival of most of the mites in the cover, including the predator mites. As the mites began to move into the tree ahead of the 2nd cover in 2002 the predator complex showed developmental characteristics similar to blocks

that had not been treated with Danitol. Following the second cover treatment where Danitol was used it was noted that the predator complex in the trees was completely killed and to a significant extent it was decreased in the cover. This observation suggests that it may be possible to incorporate Danitol into an IPM approach to CM control if it is used early and care is exercised to avoid applying materials directly to the trunk and cover.

3. Intrepid – This is a relatively new material which acts specifically on the molting process of lepodoptera larvae. Because of its specific mode of action it is generally considered to be a very safe material. Dr. Alston of U.S.U. has used this material experimentally during the 1st and 2nd generation of CM with good success. It appears to be effective when used as the 2nd cover for each generation (i.e. 2nd and 4th covers). With the recently announced agreement between EPA and Bayer to withdraw guthion from the market it will be very important to determine how this material can be used in our CM control strategy.

Recommended Codling Moth Control Program for 2003:

During 2003 most growers will be able to rely on guthion for control of CM provided sufficient attention is given to the increasing degree and extent of the "selected resistance". In a few cases growers are still obtaining 21 days of protection from an application of 1 pound active ingredient per acre. In all cases, the growers should be encouraged to do a thorough job of 'scouting' (particularly during the 14 to 21 day post application period) to avoid the damage that may occur from sudden increases in resistance. The overall effectiveness of this program is dependant on the effective use of predictive models, trapping, and thorough scouting. The days are gone when we could apply a chemical every 21 days and know that we had acceptable levels of control.

In those areas where resistance has been identified, or where growers have found more stings or worms than expected I would recommend the following CM control program.

1. The first cover should consist of 20 ounces of Danitol per acre (assuming no change in the label). This application should result in very thorough control of CM, including the adult stage in blocks where MD will be part of the program. A single application of this material, at this timing, has not given rise to other secondary pest problems, but we will need to be aware that the potential exists that this application may give rise to mite and leaf miner outbreaks (in all southern Utah County orchards changes in the mite population dynamics brought about by the decrease in rust mites and high particulate levels on the leaves makes chemical control of mites a necessity even without introducing Danitol into the pest control program).
2. The second cover should be applied at 16 to 18 days following the application of the 1st cover and should consist of 5 pounds of Imidan. This

application should be effective in controlling the CM for an additional 14 days (in a few areas for unknown reasons we have observed stings at 12 to 14 days following application of Imidan).
The combined control of this 1st and 2nd cover sprays will not be adequate to cover the entire 1st generation of CM, so the 3rd cover will be aimed at the latter portion of the 1st generation.

3. The third cover should be applied 12 to 14 days following the application of the 2nd cover of Imidan and should consist of an application of 8 ounces of Intrepid. This is a somewhat untried control strategy (on commercial blocks), but the experimental results over the last 3 years has shown it to be very effective. The grower will need to maintain an effective scouting program throughout the entire season to pick up any gaps or problems with the control program.
4. The 4th cover spray should involve application of 5 pounds of Imidan per acre when trap catches and/or temperature driven models indicate the beginning of the 2nd generation.
5. The 5th cover spray should involve application of 8 ounces of Intrepid. Again, this material has not been used extensively in commercial blocks for CM control, but research results have been impressive. If the grower is not going to adequately scout for stings and worms he should opt for application of 5 pounds of Imidan.
6. If trap catches indicate the need for a 6th cover, the decision as to the material used should be made at that time as dictated by the results of the program to that date. Because of the shorter effective residual intervals of the materials used to replace guthion, the probability that a 5th and 6th cover will be needed is very high. The effective residual period of Intrepid is dependant on the growth and development of new crop surfaces after the application, so it is dependant on a number of variables. For this purpose Intrepid should be effective for at least 14 days and under many circumstances may reach for 21 days or more.

The fruit growers of Utah face a number of difficult challenges, we have tried to address a few of them with the above research. Some of this research should be repeated for one more year (effects of oil on tree growth) and some of it will need to be ongoing to keep ahead of developing resistance and governmental regulations.