Incorporating newer insecticides into Michigan apple IPM programs: Petal-fall through June

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Figure 1. Suggested timings of various compounds against first generation codling moth

The warmth of spring brings with it a flush of growth and the beauty of apple trees in bloom. It also is the signal for many potential pests to emerge from their overwintering sites. The first generation flight of codling moth (CM) begins, adult plum curculio (PC) move into orchards, and obliquebanded leafroller (OBLR) larvae have left their overwintering sites to feed on fruit and foliage. This trio comprises the key pests that Michigan apple growers must contend with from petal-fall through June.

Among the options available for accomplishing the task are several insecticides that have been registered over the past five years. Efficacy trials conducted at the MSU Trevor Nichols Research Complex and on-farm in Michigan apple orchards have revealed that these materials can protect the crop from insect damage, but their activity on the target pests
is very different than that of conventional materials. Whereas OP’s and other broad-spectrum insecticides are highly lethal and fast acting, these new insecticide chemistries are generally weak contact poisons and produce an array of sub-lethal effects. Proper timing is needed to maximize the efficacy of these novel compounds. To do so requires an understanding of how the insecticide works, as well as the pest's biology. Not only are the newer insecticides more difficult to use than older compounds, they generally are more expensive than the compounds growers have relied on over the past 25 years.

All of the newer insecticides are effective against at least one key pest, as well as some important secondary pests that may be present in Michigan apple orchards early in the summer. Taking advantage of the activity spectrum of each material is needed if growers are to incorporate these expensive products into their IPM programs in a cost-effective manner. A summary of the relative activity of new insecticides against four primary pests and six secondary pests that may need to be controlled from petal-fall to early June (Table 1) provides a basis for determining the best fit of each compound in an apple IPM program.

**Plum curculio**

Avaunt and a trio of neonicotinoids (Actara, Assail and Calypso) are good options for protecting fruit from PC damage. Treatment at the high end of the label rate is needed to impact the tough-to-control adult PC. If pest pressure is low, a single application between petal-fall and 14 days post petal fall may be sufficient. Under higher pest pressure two applications may be required. A petal-fall spray with one of the neonicotinoids will also be active on spotted tentiform leafminer (STLM) and rosy apple aphid (RAA), while the petal-fall plus 14-day Avaunt spray will also be active on CM and Oriental fruit moth (OFM). Calypso and Assail are effective against the widest range of pests that may need to be controlled soon after bloom.
Obliquebanded leafroller
Spintor and Intrepid appear to be the most effective new options for OBLR control. Petal-fall is a good time to make the principal application. The best results are obtained when the higher rates in the recommended rate range are used. Intrepid and Spintor must be ingested by the larvae to be effective, thus uniform and thorough coverage is essential. The two insecticides will also provide good to excellent control of STLM. Avoid use of Spintor when bees are actively foraging, as this material is highly toxic to bees exposed to direct spray. Dried residues have minimal effects.

Codling moth
Among the newer options for CM control registered over the past few years are the insect growth regulators, Esteem, Diamond and Intrepid, and the neonicotinoids, Assail and Calypso. Esteem and Diamond act by suppressing development within the egg, as well as larvae that consume it. Hatching of eggs laid by treated adults will also be inhibited. Eggs are particularly susceptible to these products, thus sprays are timed earlier than most other CM control materials. Suggested timing for the first application is biofix plus 100 GDD (usually close to petal-fall, (Figure 1). Esteem will also be highly active on RAA and San Jose scale (SJS), while Diamond will provide good to excellent control of OFM, OBLR and STLM.

Intrepid provides good control of CM with a residual action of about 10-14d. This product is an insect growth regulator that primarily effects CM larvae, but also has some sublethal effects on adults. The best results have been achieved by taking advantage of the sublethal effects and applying the first spray at biofix plus 150-200 GDD (Figure 1). At this timing, Intrepid will also control OBLR larvae that are still present in orchards harboring high numbers of this troublesome pest. The addition of an agricultural adjuvant is recommended to improve initial spray deposition.
Assail and Calypso will provide good control of CM with a residual action of 10-14 days. Excellent timing and coverage is required to achieve control. The best results have generally been achieved when the first application is made prior to the start of egg hatch (ca. biofix plus 200 GDD, Figure 1). Assail is labeled for CM control at the high rate of 3.4 ounces per acre. Application rates near the high end of the label rate are also recommended for Calypso, especially where CM densities are high or for prolonged control. Field trials have indicated that use of Assail can cause outbreaks of phytophagous mites. Assail and Calypso are fairly broad-spectrum materials. In contrast to the insect growth regulators, the major secondary targets of these neonicotinoids are the sucking insects, specifically aphids and leafhoppers. The initial application of Assail or Calypso targeting first generation CM will also provide control of PC, OFM and STLM.

Warrior is a newly registered pyrethroid that can provide good control of CM. Like other pyrethroid insecticides, it appears to be more effective in the spring than summer and has a broad activity spectrum. Warrior is highly toxic to mite predators and should be used carefully to avoid outbreaks of phytophagous mites.