An Esteem-intoxicated obliquebanded leafroller larva showing deformities to its external body structures.

Transition now to new pest controls
The petal-fall spray.

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This article is the second in a series intended to help the apple industry transition insect pest management programs to the use of new pest control technologies. It discusses options for leafroller and codling moth control in the petal-fall period. Control decisions made at this time will influence future actions to control the first codling moth generation, which will be the subject of the next article in the series.

For approximately 60 percent of Washington State tree fruit growers, leafroller management begins with a delayed-dormant Lorsban (chlorpyrifos) application, usually combined with oil. Retaining the oil application at delayed-dormant is a sound pest management tactic, but many growers wanting to transition away from organophosphate insecticides are contemplating eliminating Lorsban. Even when Lorsban is applied at delayed-dormant, a petal-fall application to control obliquebanded and pandemis leafroller larvae is often necessary.

Another important pest management consideration at petal fall is codling moth control. Newly registered insecticides provide an opportunity to control leafroller larvae and codling moth eggs with the same product in a single
application. The petal-fall timing is rather ambiguous and is often determined by the need for fruit thinning sprays.

A spray timing that is optimum for fruit thinning may not be ideal for leafroller or codling moth control. Degree-day models available from Washington State University Tree Fruit Research and Extension Center via the Decision Aid System (http://entomology.tfrec.wsu.edu/das/) provide specific timing recommendations for leafroller and codling moth control. The benefit of the Decision Aid System is that it allows growers to select an application timing that best matches an insecticide's mode of action with presence of the pest's most susceptible life stage.

Products that specifically target leafrollers at petal fall include Success (spinosad), Proclaim (emamectin benzoate), and Bacillus thuringiensis (Bt) products. These insecticides should be applied at a time when the majority of leafroller larvae are in the fourth instar or earlier life stage. Applications against older larvae result in reduced efficacy and have a more disruptive impact on important beneficial insects. Although Success and Proclaim have some activity against codling moth larvae, no control can be expected at petal fall because codling moth larvae are not present.

If both codling moth and leafroller are of primary concern for growers, they should consider using an insect growth regulator Intrepid (methoxyfenozide), Rimon (novaluron), or Esteem (pyriproxifen) at petal fall. These insecticides provide good control of leafroller larvae, and have the added value of killing codling moth eggs. Timing insect growth regulators requires knowledge of leafroller and codling moth development to optimize efficacy.

First-generation codling moth adults begin depositing eggs on the leaves approximately one week after bloom. Rimon, Intrepid, and Esteem provide ovicidal control, whether applied before or after codling moth egg-laying begins (see "How ovicides work"), allowing growers to apply these insecticides between 75 and 200 codling moth degree-days. This flexibility in codling moth timing allows growers to target the most susceptible leafroller larval age without compromising codling moth control.

The best timing for Rimon and Intrepid is the peak presence of fourth-instar leafroller larvae. Esteem, which prevents the transition from the last larval stage to the pupa, works best when applications coincide with the presence of larger larvae (peak fifth instar).

A grower must consider the mode of action of each of these insecticides before evaluating the effectiveness of an application. Success and Proclaim are fast acting and highly toxic to leafroller larvae that feed on their residues, so the impact on leafrollers is readily apparent. However, Intrepid, Rimon, and Esteem, which affect normal insect development, have an extended time-to-kill period.

The full impact of their effect against leafrollers is not immediate. Dead leafroller larvae are typically not evident until 14 to 17 days following a Rimon or Intrepid application. Esteem intoxication is often not detected until leafroller larvae reach the pupal stage, and pupae can be difficult to find. Esteem-intoxicated larvae or pupae may appear normal, but on closer inspection they...
likely have some defect either to external or internal body structures that make survival and reproduction in the next generation impossible (see photo, top of page 14).

As growers begin to plan for this pest control season, use of insect growth regulator products in the petal-fall period will provide control of leafroller larvae and codling moth eggs. In addition, use of these products opens up options to control first-generation codling moth, which will be the topic of the next article in this series.