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ORCHARD FACTS

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Prune Aphids: Life Cycles and Over Wintering Biology

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The life cycle of both mealy plum aphids (MPA) and leaf curl plum aphids (LCPA) is quite complex. They both spend the winter as eggs laid at the base of buds on twigs in the outer part of the canopy of prune trees. These eggs hatch in spring to produce a series of generations of aphids on the foliage through the early part of the year. Once the prune foliage has matured, (occurs earlier on older trees than on younger or more heavily irrigated trees) the aphids migrate to alternate host plants for the summer. In the case of MPA, they migrate to cattails and this normally happens in early June, but for LCPA the migration is to composite weeds and ornamentals, such as Shasta daisy, and the flight occurs in early May. Having spent the summer on their alternate host plants both aphids return to prune orchards in the fall. The first aphids to return produce nymphs that develop on the foliage into egg-laying females. These egg-laying females must then mate with returning male aphids before they move onto the twigs to lay their overwintering eggs. Each female is thought to be capable of laying only 6-7 eggs each, and these eggs must escape the attention of generalist predators if they are to hatch the following spring.

The need to develop alternatives to dormant oil sprays for the control of aphids in prunes has generated interest in a greater understanding of the timing of the phases of the life cycle that occur late in the season through winter and into early spring. From observations using yellow pan traps filled with water to collect aphids returning to prune orchards in the fall, we have found that the return migration of male aphids of both species begins in mid October and continues through November. Field observations in the fall of 2004 and 2005 confirmed that for MPA, nymphs that are destined to develop into egg-laying females can be found in small numbers on prune trees throughout November. This suggests that fall treatments for the control of MPA could be applied as late as mid November and still result in a substantial reduction in overwintering aphid eggs. However, we have not been able to find nymphs of LCPA in prune orchards in the fall and so have not been able to confirm a similar timing for this aphid species.

Fall Spray Controls Prune Aphid the Next Season

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Summary: In three years (2003-2005) of University of California research, a fall pesticide spray consistently controlled plum aphids (leaf curl plum aphids and mealy plum aphids) the following year, providing an option to replace the dormant spray for aphid control. Options for peach twig borer and scale control are discussed.

The traditional dormant spray in prune orchards controls several key orchard pests including peach twig borer (PTB), San Jose scale (SJS), and plum aphids. However, dormant orchard spraying is increasingly regulated due to recent findings of dormant-season pesticides (diazinon, chlorpyrifos and others) in surface waters. If use of the dormant spray is eliminated or further regulated, prune growers have limited options for integrated pest management (IPM) of plum aphids. Registered, effective pesticides for aphid control (Asana®, diazinon, etc.) are broad-spectrum materials (non-selective poisons) that when sprayed in-season can harm beneficial insects that provide natural (and free!) spider mite and SJS control. To increase prune/plum pest control options, University of California researchers and farm advisors began to field test fall (late October – November) spray timings for aphid control. Both speed sprayer and handgun, single-tree trials were conducted. Low rates of labeled pesticides (Asana®, Imidan®, diazinon, and/or Actara®) were tested. Oil was not included with pesticide treatments, as previous studies showed it did not affect aphid control, and use of oil is incompatible with zinc sulfate, a foliar nutrient commonly applied in the fall. In all three years of this study (2003-2005), fall pesticide applications gave excellent plum aphid control the following year. There were distinct differences between pesticide materials (see Table 1) with the more persistent materials were, more effective for aphid control. In Fall 2005, at least three large scale grower tests using Asana® (totaling over 1000 acres), produced effective aphid control in spring 2006.

Based on these consistently positive results, prune growers can add a fall spray to their list of effective options for plum aphid control. This spray timing is very effective on the most important pest in plum/prune production. Fall spraying is generally easier to plan due to better weather conditions and could become the preferred spray timing for orchards on heavy ground where orchard access is often difficult during January and February.

While the fall spray has not yet been shown to be a complete dormant spray replacement, there are other effective options for PTB that allow growers to avoid spraying in the full dormant season (January and February). Effective PTB control practices that compliment a fall spray for aphids include a bloom spray or in-season spray with materials that don't harm beneficial insects and mites. These materials include B.t. (Dipel®, Javelin®, etc.), Intrepid ® and Success®.

What about scale? Because coverage is so important in scale control, delayed dormant timing is still the best option for scale control. However, in our experience, few orchards in the Sacramento Valley

have enough scale to justify spraying. A dormant spur sample is the best way to check orchard scale levels. When results of this simple test show a need for scale control, high rates of oil (4 gallons/acre) can give good control of low to moderate SJS populations when applied in the delayed dormant period. An effective pesticide (Supracide®, diazinon, Lorsban®, Seize®, etc.) should be added to the tank with a dormant oil if high scale populations exist. If the dormant treatment is skipped and scale is noted in spring, an in-season spray with oil and/or Seize® can give good scale control if necessary.

Table 1. Plum aphid control materials, rates, and relative control results when sprayed once from mid-October through November.

Material	Rate/acre	Aphid control
Asana®	3*-4.8 oz	Excellent
diazinon	2 pints	Fair – Good
Imidan®**	2.125-4.25 pounds	Good -- Excellent
Actara®	3 oz	Good -- Poor

*Below labeled rate.
** Imidan was tested because it breaks down quickly in water and will have less impact on surface water quality and aquatic life.

In addition, we have been estimating the timing of egg hatch of both MPA and LCPA from examination of aphid eggs collected at regular intervals from prune orchards in the Winters area in 2004-05 and 2005-06. Before egg hatch can take place, aphid eggs must first complete an obligatory phase of overwintering diapause that is determined by chilling, in much the same way that prune buds require chilling to terminate dormancy. For MPA, we estimated that diapause was completed around Jan. 24 in 2005, but somewhat earlier around Jan. 9 in 2006. We found sufficient eggs of LCPA in only one of these two years and estimated the end of diapause to be Feb. 2 in 2006, later than that for MPA. The time taken for eggs to hatch after diapause is completed depends on the accumulation of sufficient temperature above a threshold, for egg development to reach the thermal requirement for egg hatch. The threshold temperature for development for both aphids is 37-39°F and preliminary data suggest that eggs of MPA have a higher thermal requirement for egg development than eggs of LCPA. An earlier termination of diapause coupled with a higher thermal requirement for egg hatch in MPA, with the reverse being the case for LCPA, results in a very similar timing of egg hatch for both aphid species. We estimated egg hatch to be around Feb. 17 in 2005 and Feb. 12 in 2006 for MPA and Feb. 12 in 2006 for LCPA.

These investigations will help us to clarify the windows of activity of prune aphids both in the fall before egg laying begins and also in the spring after egg hatch. This information will be very valuable for understanding the options for timing of either pre-dormant or delayed dormant control treatments for aphids as alternatives to dormant sprays.

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