Section 6

Secondary Pests

Washington State University

Apple Pest Management Transition Project

Tree Fruit Research & Extension Center

Secondary Pests

While the Pest Management Transition Project is focusing on the challenges of moving the apple industry from use of organophosphate (OP) insecticides for key pests, codling moth and leafrollers, to registered alternatives, the whole orchard pest management system must be considered. Most of these pests would be classified as secondary, because control of these pests does not shape our IPM programs; indeed, many indirect pest problems are induced by the control measures for direct pests. Transitioning to OP alternatives can increase concerns with some secondary pests but could reduce concerns with others.

Woolly Apple Aphid Colony - E. Beers

Woolly Apple Aphid

One pest that stands out as increasing in importance in the OP transition scenarios is the woolly apple aphid (WAA). Research has shown that pre-bloom applications of Lorsban (chlorpyrifos) suppress WAA colonies and delay the build up of colonies on the tree. Diazinon, an OP insecticide, has been used for years to manage WAA when populations exceed tolerances. Diazinon and Thiodan labels carry increasing levels of restrictions, but these materials can still be used to control WAA. There is a suggestion that certain OP alternative insecticides are interfering with biological control of WAA leading to more frequent and larger out breaks of this pest than in the past. New insecticides for control of woolly apple aphid are lacking, but there may be options in the future.

European red mite - E. Beers

Spider Mites

Twospotted spider mite- E. Beers

Spider mites (European red mite - image left, twospotted spider mite - image at right, McDaniel mite - image below left) have historically been controlled in apple orchards by the western predatory mite. This predator became highly resistant to OP insecticides over 30 years ago, and functioned well when apple pest control depended primarily on OP insecticides. Some of the OP alternative insecticides, Assail, Calypso, and possibly Rimon, have disrupted biological control of spider mites and growers have experienced mite populations that require applications of specific miticides. Understanding what products contribute to the disruption of integrated mite control will help reduce pest management costs by re-establishing biological control of spider mites, thus eliminating the use of specific miticides.

McDaniel mites - E. Beers

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Secondary Pests

Western Flower Thrips

Thrips damage - E. Beers

Thrips migrate into orchards in the spring and cause injury to certain apple varieties when they lay an egg in a developing fruitlet. This injury is still visible at harvest on light-colored fruit and can cause a downgrading of fruit. OPs have not been an option for thrips control in the past because of the near-bloom timing. Precise timing of thrips materials is essential for good control.

Stink Bugs

Consperse stink bug

There are several species of insects that are referred to generally as “stink bugs”. They get their name because of glandular secretions they emit when disturbed, like when you pick one up. Problems with stink bugs over the last decade have been attributed primarily to the Consperse stink bug (image at right). Recently other stink bug species, like the green solider bug (image below) have been implicated in crop losses. Stink bugs reproduce outside of the orchard but damage fruit in late summer and fall when as adults they migrate into orchards. There are no effective OP alternative insecticides to control these pests except pyrethroids (Danitol, Asana, Warrior). While we do not recommend use of these products in apple orchards because of negative effects on biological control, they are recommended for control of stink bugs when the crop is threatened from adults invaders in late summer or fall. Damage from stink bugs can be confused with bitter pit. Traps are available to help monitor stink bug presence near or in orchards.

Green soldier bug

Lacanobia fruitworm

Other Pests of Interest

Western tentiform leafminer

Leafhoppers, Leafminer,
Lacanobia fruitworm,
Green Aphids, Rosy Apple Aphid

OPs have not been effective on many of these indirect pests for decades; if anything, the OP-alternative materials (e.g., the neonicotinyls) are more effective, and may have contributed to a decline in pest status of these insects (leafhoppers, leafminers, green aphids). One exception is rosy apple aphid; although the neonicotinyls are effective, their timing for lepidopteran pests is generally too late for damage prevention.

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Integrated Mite Management in Apples

Current status of mites in apples

Spider mites have historically been controlled in apple orchards by the western predatory mite. This predator became resistant to OP insecticides over 30 years ago and functioned well in Guthion-based codling moth programs. Uncontrollable outbreaks during the 1960's were stabilized by biological control. By the mid-1990s only 10% of the acres in Washington required insecticidal control of mites.

Western predatory mite feeding on European red mite - E. Beers

However, some of the OP alternative insecticides (Assail, Calypso, and Rimon) have disrupted biological control of mites. In 2005, 55% of Washington apples required a miticide. Understanding what products contribute to the disruption of integrated mite control will help reduce pest management costs by re-establishing biological control, thus eliminating the use of specific miticides.

The role of apple rust mites

Moderate densities of rust mites are considered beneficial on apples. Rust mites serve as an alternate food source for predatory mites, allowing them to survive in periods of low spider mite densities. Care should be taken to preserve rust mites during early season insecticide, fungicide, and thinning spray programs. Predator populations that thrive on rust mites early in the season can maintain spider mite densities below detectable levels during the summer months.

Environmental and cultural influences on mites

Rust mite populations tend to crash during periods of prolonged hot weather. Without this alternate food source, the number of predatory mites may also decline making trees more vulnerable to attack from spider mites. High spider mite populations have been associated with hot, dry summers. Spider mite population increases have also been associated with dusty foliage, especially next to dirt roads. Rainy, cool weather may reduce mite survival and thus suppress spider mite populations. Cold, dry winters can reduce the number of overwintering predatory mite adults.

It is possible to reduce two spotted spider mite populations with overtree irrigation either by modifying the climate, reducing dust on the leaves, or simply by washing mites from the tree. Red mites do not seem to be affected by irrigation practices.

Remember, mites are not a problem in unsprayed orchards. The mite problems seen in commercial orchards occur when they are liberated from biological control.

Reestablishing Predators in Disrupted Orchards:

"Seed" orchards to hasten recolonization by predators.

- Transfer growing shoots with rust mites and predatory mites to orchards with disrupted biological control.
- Place at least one shoot in each tree.

Purchase insecticide resistant predators from an insectary.

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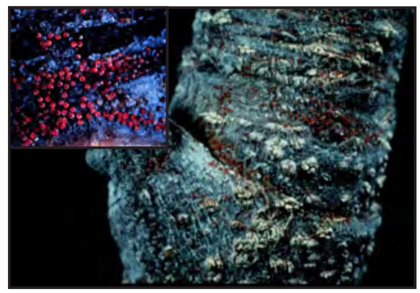
Integrated Mite Management in Apples

The effect of early season spray programs on mites

Apple growers have a long history of using lime-sulfur early in the season for disease management with little impact on mite management. However, the increased rates and frequency of applications used in thinning programs has been associated with negative impacts on predatory mites, and high mortality of rust mites. Ammonium thiosulfate and carbaryl are also toxic to predatory mites. Thinning sprays are one of the most important programs for determining profitability for apple growers. Therefore, pest management programs must be able to adapt to thinning programs, but growers should be aware of the potential negative impacts of some product choices.

Insecticide programs that impact mites



As growers move away from a reliance on OP insecticides, many are choosing not to use Lorsban at Delayed-Dormant. However, it is still very important to apply oil at the half-inch green stage to control red mite eggs. Eggs are most vulnerable just prior to hatch, thus a true dormant oil application is not as effective.

Carzol use against thrips has the negative side effect of being highly toxic to both predatory mites and rust mites. Assail, Calypso, and Rimon use against codling moth have been implicated in disruption of mite biological control. Summer kaolin sprays have been shown to be repellent to predatory mites. Pyrethroids have long been known to cause disruption to some of the most stable biological control programs.

The negative effects associated with thinning and insecticide programs can be additive, leading to an unstable mite situation. The probability of a mite outbreak increases with the number of disruptive applications.

Before deciding if a miticide application is warranted, consider these factors:

- Mature, vigorous trees with moderate crop load can tolerate a considerable amount of mite feeding.
- Mite damage is worse in orchards that are water stressed by hot, dry, windy weather, and soil with poor water retention.
- Summer oils can be used to suppress moderate populations so that conventional miticides are not needed.

Choosing a miticide

One of the most important considerations when choosing a miticide is selectivity. Many miticides are more toxic to predators than the targeted spider mites. The use of selective miticides can assist the establishment of biological control. Further, miticides with low toxicity to rust mites will help to stabilize integrated mite control.

Important Spray Considerations:

- Use delayed-dormant oil against overwintering red mite eggs.
- Protect apple rust mites whenever possible.
- Avoid products that kill or disrupt predatory mites.

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Integrated Mite Management in Apples

Active Ingredient	Trade Name	IRAC	Class	MoA	Target	ERM	TSM	ARM	Typh
Miticides									
Horticultural mineral oil	Omni Supreme	none	Oil	Suffocation	Egg	3-4	2-3	2-3	M
Petroleum oil	Saf-T-Side					2-3	2-3	2-3	M
Abamectin	Agri-Mek	6	Avermectin	Chloride channel activator	Early Season	3	3	4	H
Clofentezine	Apollo	10	Non-specific	Mite growth inhibitor	Egg	2-4	---	1	L
Etoxazole	Zeal				Egg/Larvae	3-4	3-4	---	---
Hexythiazox	Savey				Egg/Larvae	2-4	---	1	L
Fenbutatin oxide	Vendex	12	Organotin	Inhibit ATP synthase	Motile	1-4	2-3	3-4	M
Fenpyroximate	FujiMite	21	METI Inhibitor		Motile	4	---	M	M
Pyridaben	Nexter					4	2-3	4	M
Spirodiclofen	Envidor	23	Tetronic acids	Inhibit lipid synthesis	All stages	3-4	3-4	---	---
Bifenazate	Acramite	25	Bifenazate	Neuronal inhibitor	Motile	3-4	4	---	L
Nutrition, Disease, Thinning, Horticulture									
Lime Sulfur	Rex	none	Calcium sulfur	Caustic	Thinning/ Disease	---	---	H	M-H
Amonium thiosulfate	ATS	none	Thiosulfuric acid	Caustic	N + S	---	---	---	M-H
Carbaryl	Sevin	1	Carbamate	Ach-ase Inhibitor	Thinning	---	---	2	M-H
Kaolin	Surround	none	Particle film	Irritant	Sunburn	---	---	---	M-H
Limit use of these insecticides to preserve mite biological control									
Formetanate hydrochloride	Carzol	1	Carbamate	Ach-ase Inhibitor	WFT	3	2	3	M-H
Methomyl	Lannate				Leps	---	---	L	H
Oxamyl	Vydate				WTL	2	2-3	3	M-H
Endosulfan	Thionex	2	Organochlo-rine	GABA chloride antagonist	Various	2	---	M-H	L
Fenpropathrin	Danitol	3	Pyrethroid	Sodium channel modulator	Various (also CM)	---	---	---	H
L-cyhalothrin	Warrior					---	---	---	H
Acetamiprid	Assail	4	Neonicotinyl	Nicotinic receptor agonist	CM	Unknown mechanism of disruption			
Thiacloprid	Calypso								
Novaluron	Rimon	15	Benzoylurea	Inhibit chitin synthesis	CM / LR	Unknown mechanism of disruption			
Potassium salts/ fatty acids	M-Pede	none	Fatty acids	Membrane disruption	WAL	---	---	M	M

Rating System: 4 = excellent control; 3 = acceptable in low pressure situations; 2 = suppression activity only; 1 = poor control; L = low impact; M = moderate impact; H = high impact; --- = no data.