scaffolds FRUIT JOURNAL

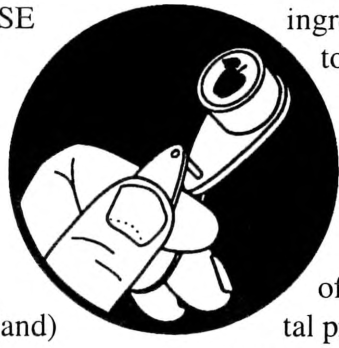
Update on Pest Management and Crop Development

March 27, 2000 VOLUME 9, No. 2 Geneva, NY

DISEASES

STRANGE BREW

APPLE DISEASE CONTROL WITH NEW FUNGICIDES



Wayne Wilcox and Dave Rosenberger
(Plant Pathology, Geneva and Highland)

❖❖ Apple growers have two new options for controlling diseases this season. "Sovran" from BASF and "Flint" from Novartis are broad-spectrum fungicides from the new chemistry class commonly known as strobilurins. Both materials received federal registrations for pome fruits (apple, pear, and quince) in 1999, and New York State registrations are now in place as well. They are welcome additions to the "tool chest", not only because of their inherent activities, but because they should take some pressure off the SI fungicides. This is important not only where the SIs have begun to "slip" due to resistance development, but also where they haven't (i.e., let's keep it that way). In an ideal world, each fungicide group would help keep the other alive.

Origin and mode of action of strobilurin fungicides:

Strobilurin chemistry was derived from a natural anti-fungal compound that occurs in a small mushroom, *Strobilurus tenacellus*, which grows on fallen pine cones in Europe. Chemists in several companies modified the original compound to make it more stable and more effective as a fungicide.

The strobilurins are very active against a wide array of plant pathogenic fungi, generally at rates of only one to three ounces of active ingredient per acre. They have very low toxicity to birds, earthworms, beneficial insects, predaceous mites, and mammals (including humans). They break down quickly in soil but have good residual activity on foliage and fruit. Because of their broad spectra of activity and favorable environmental profiles, they are the most significant new group of fungicides to be developed since the sterol inhibitors.

Unlike the SI fungicides, the strobilurins are excellent inhibitors of spore germination; thus, they are excellent protectant fungicides. These materials are retained primarily within the waxy cuticle of leaves and fruit, which means that they are more rainfast than traditional protectants. This also means that they don't redistribute very

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well from leaf to leaf in rainwater, although they do redistribute well within the waxy layers of a given leaf (or fruit). Furthermore, a small portion of the total dose does diffuse from the surface of a sprayed leaf and, after a few days, enough accumulates on the other side so that it offers fungicidal protection on that unsprayed side (termed "translaminar" activity). This general pattern of fungicide movement is unique to the strobilurins, and different manufacturers have made up their own trademarked names to describe it, e.g., "surface systemic" for Sovran and "mesosystemic" for Flint. You'll be hearing these terms in the advertisements.

In addition to being excellent protectant fungicides, the strobilurins are powerful antisporulants. That is, when applied beyond their period of true "kickback" activity, they allow lesions to develop but few secondary spores form on these lesions. This is particularly significant for a disease like apple scab, where economic damage (fruit scab) is usually caused by the secondary spores that develop on infected leaves. For instance, in trials conducted in Geneva in both 1996 and 1998, early infection periods were missed (unintentionally) and significantly less fruit scab developed when the first two sprays consisted of a strobilurin (Sovran in 1996, Sovran or Flint in 1998) rather than an SI plus mancozeb. This reduction in fruit scab was directly related to the reduced number of sporulating lesions produced on cluster leaves treated with strobilurins in the early sprays versus those treated with other materials.

The strong protectant and antisporulant activities of these materials are functions of their retention in the cuticle on the surface of the leaves and fruit. Conversely, good curative or kickback activity usually requires a fungicide to penetrate the cuticle and get inside the leaf, i.e., to get down where the fungus is doing its business after it's established an infection. Thus, the strobilurins generally are not as effective in a kickback mode as are compounds with a higher degree of systemic activity, such as the sterol inhibitors. However, apple scab may provide an exception to this general rule. That is, the apple scab fungus grows just beneath the cuticle, so enough fungicide to provide true postinfection control may actually "leak through" the underside of the cuticle and do the job. Both Flint and Sovran are labeled to provide approximately 4 days of postinfection control for apple scab. At this point, however, the trials that have led to these claims are extremely difficult to evaluate, and it's not clear whether postinfection sprays truly kill the incipient infections or merely keep them from sporulating (in which case, they could potentially reactivate without additional applications of the fungicide). There is no question that Sovran and Flint provide scab control when applied postinfection, but it seems risky to deliberately design postinfection control programs with these materials until more is known about the details just discussed.

Used alone without contact fungicides, Sovran and Flint will perform in the orchard similarly to SI-protectant tank mixes in their heyday. It is important to recognize that these strobilurin fungicides control scab (and many other diseases) on apple fruit at least as effectively as mancozeb and captan, and much more effectively than SI fungicides ever did when the SI's were applied alone. Sovran is labeled for

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use at 10–14 day intervals, whereas Flint is labeled for use at 7–10 day intervals. Based upon limited comparisons of the two (Flint has only been available to the university community since 1998), it would appear that this difference in recommended spray intervals is a result of "product positioning" by the respective manufacturers rather than differences in product activity. Spray intervals of greater than 10 or 11 days are not recommended during the primary scab season, due in part to the need to cover new tissues as they emerge.

What about fungicide resistance?

Strobilurin fungicides work by inhibiting a single biochemical pathway involved in mitochondrial respiration in fungal cells. Mitochondria are the energy-producing units within cells, so disrupting mitochondrial function results in death of the fungal cells as they "run out of gas". Because strobilurins inhibit a single biochemical step, resistant strains of various pathogens will develop if these fungi can utilize an alternative biochemical pathway that bypasses the step blocked by strobilurins. Resistance to strobilurins has already appeared in powdery mildews of cereal grains and cucurbit crops in Europe and Asia, as well as in *Botrytis* of greenhouse crops. Thus, resistance is a very real concern, and resistance management must be incorporated into plans for using strobilurin fungicides from Day 1 of their introduction.

To date, strobilurin resistance appears to follow the "Benlate model"; that is, resistant isolates are virtually immune to the fungicides and multiply rapidly if they are not controlled by some other material. Furthermore, a fungal strain that is resistant to Sovran will be resistant to Flint and vice versa. Therefore, both companies have agreed on identical labeling which requires use patterns that incorporate resistance-management principles: (i) No more than four sprays of any strobilurin may be used per season; and (ii) A strobilurin fungicide can be used no more than three times in a row; if two or three sequential applications are made, an effective unrelated fungicide must be used in the next two applications before strobilurin use can resume.

Note that tank-mix combinations are NOT a part of this strategy, and that both fungicides are priced to be used alone. Thus, this strategy is to (i) minimize the selection of resistant strains by limiting the number of selection events (sprays); and (ii) limit the opportunity for resistant strains to multiply, by using unrelated fungicides in rotation. Restricting the number of sequential strobilurin sprays to two might be an even more effective anti-resistance strategy, although three is legal. Economics will help enforce the limited-spray strategy, but it is important that growers and advisors not deliberately short-circuit the intent to limit the buildup of resistant fungus strains; e.g., by failing to rotate with effective unrelated materials. For instance, rotating Flint or Sovran with only benzimidazole/captan sprays would not be a good resistance-management strategy with respect to the powdery mildew fungus, because mildew is already resistant to the benzimidazoles in many orchards.

Strobilurin fungicides can be phytotoxic to some crops:

Sovran is phytotoxic to a few sweet cherry varieties and therefore will not be registered for cherries. All of the foliage on Somerset, Sweetheart, Valera, Van, and Vandalay can be killed if trees are sprayed directly with Sovran. Less severe phytotoxicity (mostly leaf spotting) has been observed on Cavalier, Emperor Francis, Royalton, Schmidt, Summit, and Viva trees that have been sprayed directly. Drift (other than direct blow-through) and the concentrations resulting from residue remaining on spray tank walls are believed to pose relatively little danger. Tart cherries and other sweet cherry varieties show little or no phytotoxicity from Sovran, even when sprayed directly.

Flint is phytotoxic to Concord grapes when applied directly, and is specifically not labeled for use on that variety. Azoxystrobin (Abound, Quadris), another strobilurin fungicide which is registered for use on grapes and some vegetable crops, is ex-

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tremely phytotoxic to certain apple varieties (e.g., Macs, those with Mac parentage, and Gala), even at very low concentrations resulting from drift or spray tank residue. Thus, each of these strobilurins has a problem with phytotoxicity to a few varieties of one specific crop. Fruit growers producing apples and stone fruits or apples and grapes may wish to consider the potential for phytotoxicity when selecting which of these fungicides they will use on their farm.

Sovran and Flint provide excellent control of apple diseases:

In university trials, Sovran and Flint have provided excellent control of apple scab, powdery mildew, sooty blotch, flyspeck, and black rot. Both Sovran and Flint provide only marginal control of cedar apple rust and quince rust, especially when used at the lower end of labeled rates.

Which product is better, Sovran or Flint? That depends primarily on the rates of the respective products that are used in comparisons. Evidence to date suggests that Sovran and Flint provide comparable control of apple diseases when the rate of Sovran is double the rate of Flint. Thus, Sovran at 4 oz/A will provide the same level of control as Flint at 2 oz/A, and early indications are that the products will be priced accordingly. The Sovran label gives recommendations in rates per 100 gallons (1.0–1.6 oz) as well as rates per acre (4.0–6.4 oz) whereas the Flint label lists only rates per acre (2.0–2.5 oz). The minimum labeled Sovran rate of 1.0 oz/100 gallons may prove marginal under high apple scab pressure, based upon experience in our high-inoculum test orchards at both Highland and Geneva. Experience with Flint is more limited, but a rate response was also seen in the one comparative study conducted in Geneva. That is, a rate of 0.5 oz/100 gallons—presumably equivalent to the 1.0 oz/100 rate of Sovran—was less effective than a higher, unlabeled rate (1.0 oz/100).

Therefore, we suggest that apple growers in New York use Sovran at a minimum rate of 1.33 oz/100 gallons of dilute spray for tree-row-volume applications. Technical support personnel from BASF recommend a minimum of 2.0 oz/acre even on the smallest trees, a recommendation that prudently recognizes the potential inefficiency of spray capture in small trees and the relatively high crop value in high-density plantings. We recognize that a rate of 1.0 oz/100 for Sovran may be adequate for purely protective sprays under modest pressure, but both the label and our personal experiences indicate the need for higher rates if postinfection activity is required. The minimum rate for Flint is 0.67 oz/100 gallons dilute basis. The latter is based not only on the 2:1 formula for Sovran:Flint, but also is derived by dividing the lowest label rate (2 oz/A) by 3, using the increasingly standard assumption that per-acre rates must be divided by 3 to arrive at rates per 100 gallons for apples in New York State. A common "fudge factor" (at least 150 gallons/A dilute basis, even on the smallest trees) yields a minimum per-acre rate of 1.0 oz for Flint.

Suggested use patterns for Sovran and Flint:

What is the best timing for strobilurin fungicides? There is no single "correct" answer. However, we believe that the best timing in many locations is around the tight cluster plus pink bud stages, except in areas where quince rust is a concern. Applications at tight cluster and pink target the period of peak apple scab ascospore discharge and the beginning of the mildew season, and they will also suppress secondary spore production on lesions that managed to sneak through in earlier infection periods. Sovran or Flint applied at these early stages, before SI fungicides are used, will help "break the cycle" and limit the ability of SI-resistant scab and mildew strains to re-establish on new foliage. Using Sovran or Flint to control early-season infections will result in less selection pressure for scab and mildew strains resistant to the strobilurins because inoculum levels are lowest early in the season (an example of the old concept that *X* % resistant strains in a small population provides fewer problem individuals than *X* % resistant strains in a large population). Combinations of contact and

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SI fungicides can then be used at petal fall and first cover to provide continued protection against scab and mildew. Having a contact fungicide present at petal fall should reduce potential risks from a myriad of minor diseases for which we still have limited data on activity of strobilurin fungicides.

A typical apple fungicide program might therefore involve an initial application of a protectant fungicide (maybe two in very wet years), followed by two sprays of Sovran or Flint at approximately 10-day intervals starting about tight cluster. A single mancozeb spray may be needed during an extended bloom period to bridge the gap between the second strobilurin spray and the petal fall application. At petal fall and first cover, an SI-contact combination could be used to round out the scab and mildew season. If desired, a final strobilurin spray could be used to extend the period of optimal scab and mildew control and provide excellent flyspeck control, before switching to routine summer fungicide programs; or, summer programs could be initiated now. In blocks where scab pressure is low and no mildewcide is needed, the SI's might be omitted and contact fungicides used alone to provide protection through petal fall and early summer.

In blocks where quince rust is a concern, the SI-contact combination should probably be used at tight cluster and pink, the period when quince rust infections occur on fruit. Sovran or Flint could then be used at petal fall and first cover when fruit are no longer susceptible to rust. Sovran and Flint will provide acceptable (but not perfect) protection of leaves against cedar apple rust, but they will not provide adequate protection against quince rust on fruit during the tight cluster and pink stages.

Sovran and Flint are very effective for controlling flyspeck (and sooty blotch) and could be used as substitutes for benzimidazole-captan sprays during summer, especially where the four-day re-entry interval for captan creates management problems. The best timing for Sovran and Flint in summer sprays remains to be determined, as does their cost effectiveness at this time in much of the Northeast.

If Sovran or Flint scab sprays are applied at tight cluster and pink, then they should not be used again until second cover. During early summer, good spray coverage is still possible, whereas dense foliage, fruit clustering, and limbs drooping under heavy crop loads often compromise spray coverage in late summer. However, if Sovran or Flint scab sprays are applied at petal fall and first cover, then additional summer applications would need to be delayed until July or August because of the requirement for intervening applications with some other class of fungicides.

Sovran has a 30-day preharvest interval and the label indicates that it should not be used as the last spray of the season. This prohibition was based on the assumption that growers might apply Sovran for scab control starting at green tip, and using it both to end the season and begin the following season would compromise resistance management. Flint has a 14-day preharvest interval, and Novartis has actively investigated the value of late-summer sprays. Both Flint and Sovran appear to have residual activity against flyspeck that is equivalent to that provided by Benlate and Topsin M. ❖❖

FIELD NOTES

HUDSON VALLEY

APPLE SCAB UPDATE

(Dave Rosenberger, Plant Pathology, Highland)

Apple Scab:

❖❖ Squash mount assessments of scab ascospore maturity were made March 16 and again March 23 with leaves collected from an abandoned orchard in Highland, NY. No mature ascospores were found in either evaluation. These results suggest that ascospore maturity for this spring is lagging tree phenology. Early scab infection periods should pose relatively little risk for infections in commercial orchards as compared with 1998 when ascospore maturity was very early or 1999 when maturity was "on time" in relation to tree bud stages.

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Reasons for the delayed scab ascospore maturity this year are not known with any certainty. However, the relatively dry spring to date may have left the overwintering leaf litter too dry for optimal development of scab ascospores. At the same time, drier-than-usual conditions may be allowing more rapid soil warming. Warm soils and recent warm night temperatures may be promoting tree development at the same time that ascospore maturation is being delayed by dry conditions.❖❖

GENERAL INFO

GETTING IN GEAR

PLAN FOR PEST MANAGEMENT NEEDS AND ORDER SUPPLIES

(Deborah Breth, Lake Ontario Fruit Program, Albion)

❖❖ Controlling pests and producing quality fruit requires a combination of many observations. We monitor weather conditions, including maximum and minimum daily temperatures, leaf wetness duration, and precipitation. This information is used to detect infection conditions for specific diseases, and keep track of heat units as degree days. This information is used to time scouting activity and specific applications towards insects and diseases. We use insect traps with either food attractants or sex pheromones as lures to detect flight of insect pests. We sample leaves looking for specific population densities of insects and mites. And we keep records of scouting results in each orchard to complete the recordkeeping, and evaluate control results at the end of the season with harvest evaluations and spray records.

Weather equipment

The minimal weather monitoring equipment includes a max-min thermometer and a rain gauge. Be certain to keep the thermometer out of the direct radiation of the sun. Record maximum and minimum temperatures daily and reset the thermometer at the same time every day. This is not adequate information to determine disease infections conditions.

Other weather data collection equipment can be used, but you must maintain this equipment like you maintain your tractor, or better. Hemp strings used for leaf wetness monitoring do wear out and stop responding to rainfall — and must be replaced. Check with the manufacturer of the weather equipment to be sure it is accurately calibrated.

Insect traps and lures

Trapping insects is not usually done to determine if a pest population is significant, but rather when it must be monitored or controlled. For some pests we use the first trap catch date as the "biofix", the starting point to accumulate heat units or degree days. With many pests we follow up the trap catch with a scouting session to assess the pest level. Trap types and placement in and around the orchard are critical.

The basic traps recommended for IPM programs in apples are used to monitor pests including obliquebanded leafroller, codling moth in problem or low-spray blocks, and apple maggot. In peaches, it is important to trap for oriental fruit moth, lesser peachtree borer, and peachtree borer. In apples with dwarfing rootstocks, it is wise to trap for dogwood borer, and, in sites close to run-down cherry and peach blocks, American plum borer. Tarnished plant bug traps have not been useful in determining potential damage in apples. In cherries, it is important to trap for cherry fruit fly.

What traps? What lures? How many traps do I set? Where do I hang the traps and when? These questions must be answered for each specific pest. You can find the answers in the following table.

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Visual Aids

Scouting requires some visual aids to identify fruit pests and predators and to magnify these small animals. IPM fact sheets are available on the web and in hard copy to help identify fruit pests and predators. To monitor pests and diseases, magnification is necessary for many pests depending on your clarity of vision. Magnification aids include a handlens, 10x and 20x (for rust mites), and a glass binocular magnifier (Donegan OptiVisor (3.5X)). You may need to use a counter so you can scout without losing your count while looking at other things in the orchard. Remember to carry sample bags to collect unknowns for your local fruit specialist. Oh, yes, some say they need an ATV to scout! Have fun!

Pest	Crop	Approx. date/ DD (base temp)	Trap type	How Many per Block	Where
OBLR	Apples plus	June 1 or earlier, when pupae noted in orchard	wing	2–3	head height in center of block
Codling Moth	Apples, pears	Apple bloom 484 DD (43°F)	wing	2–3	around borders near woods or alt. hosts
Dogwood Borer	Apples	July 1	wing	1–2	block interior
Apple Maggot	Apples	July 1	red sphere w/wo apple volatile lure	3–4	around border of orchard near likely source
Oriental Fruit Moth	Apples, peaches	Pink	wing	4–5	around border
Cherry Fruit Fly, Black Cherry Fruit Fly	Cherries	Mid-June 1025 DD (43°F)	yellow board	2–3	around border of orchard near likely source
American Plum Borer	Stone fruit (and nearby apples)	Tart cherry bloom 423 DD (43°F)	wing	2–3	block interior
Lesser Peachtree Borer	Peaches, cherries	End of May 580 DD (43°F)	wing	2–3	block interior
Peachtree Borer	Peaches	Mid-June 1025 DD (43°F)	wing	2–3	block interior

GETTING YOUR GEAR IN TUNE

SPRAYER PREPARATION - PART II

(Andrew Landers, Agricultural and Biological Engineering, Ithaca)

Air Blast Sprayer Calibration (use clean water)

- Pressure check

Place the pressure gauge on the nozzle fitting farthest away from the pump and turn the sprayer on. If pressure is lower at the nozzle than specified, increase pressure at the regulator.

Pressure at nozzle ____________________psi

Pressure at sprayer gauge____________________psi

- Nozzle output

— Use a flow meter (obtainable from Gemplers, Spraying Systems, etc.) attached to individual nozzles OR

— Connect hoses to each of the nozzles and measure the flow from each nozzle into a calibrated jug.

Remember: 128 fl. ozs in one gallon. Example: If the output of one nozzle has been measured at 34.5 fl.ozs, then output is divided by 128 = 0.27 GPM in one minute.

Replace all nozzle tips that are more than 10% inaccurate.

Formula: $\frac{\text{Total GPM} \times 495}{\text{mph} \times \text{row spacing (ft)}} = \text{GPA}$

Your figures: $\frac{\_\_\_\_ \times 495}{\text{mph} \times \text{ft.}} = \text{GPA}$

Travel Speed Calibration

Travel speed is a critical factor in maintaining accurate application rates and will influence spray deposition depending on location within the canopy. The slower a sprayer travels, the greater the uniformity in spray deposition. Although there is inconsistency in research results that try to determine the effect of travel speed on average spray deposition, all studies to date have been in agreement that the higher the travel speed, the greater the variability in spray deposit. Variation in spray deposit is an

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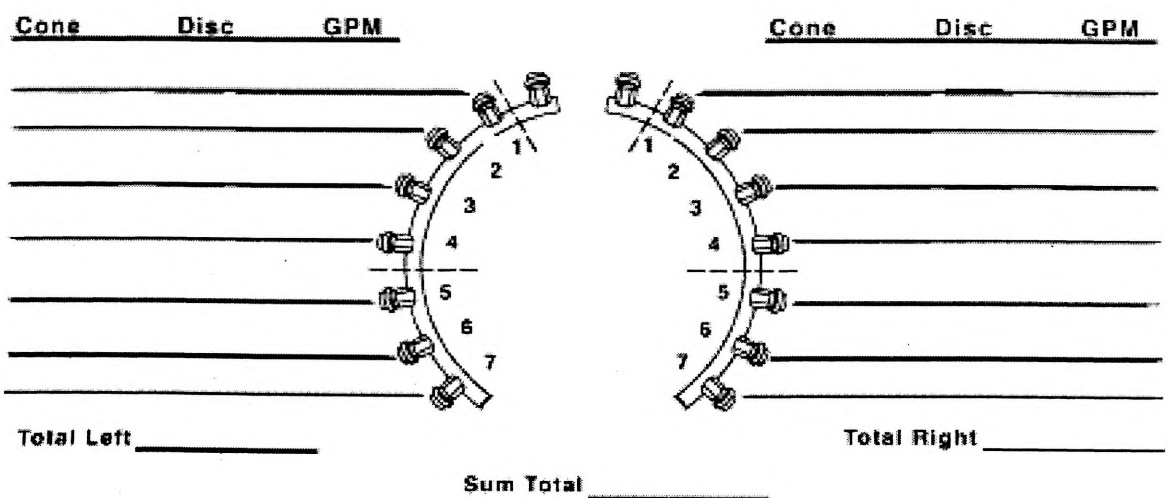

important factor where uniformity of spray coverage throughout the canopy is required. Conclusions from research were drawn using travel speeds of 1–4 mph.

Factors that will affect travel speed include:

- weight of sprayer to be pulled
- slope of terrain
- ground conditions traveled over (wheel slippage!)

The best way to measure travel speed is to pull a sprayer with tank half filled with water on the same type of terrain that the sprayer will be operated on.

Set up test course at least 100 feet long, measure the course with a tape measure. Do not pace the distance. The longer the course the smaller the margin of error. Run the course in both directions.

Use an accurate stop watch to check the time required to travel the course in each direction. Average the two runs and use the following formula to calculate the speed in MPH.

Formula: $MPH = \frac{\text{ft. traveled}}{\text{sec. traveled}} \times \frac{60}{80}$

Your figures:

Tractor gear__________Engine revs.____________

$MPH = \frac{\text{ft. traveled}}{\text{sec. traveled}} \times \frac{60}{80} = \_\_\_\_\_\_ =$

❖❖

INSECT TRAP CATCHES (Number/Trap/Day) Highland, NY

	3/20	3/27
Green fruitworm	0	1.4*
Redbanded leafroller	0	0.5*
Pear psylla (eggs/100 buds)	3.0*	42.0

* 1st catch

PEST FOCUS

Highland:
Pear psylla eggs observed. **Green fruitworm** and **redbanded leafroller** beginning to fly.

PHENOLOGIES

Geneva,
Apple (McIntosh): silver tip

Highland:
Apple (McIntosh): green tip
Pear (Bartlett):swollen bud
Peach: early green tip

UPCOMING PEST EVENTS

	43°F	50°F
Current DD accumulations (Geneva 1/1–3/27):	138	57
(Geneva 1999 1/1–3/27):	32	6.5
(Geneva "Normal" 1/1_3/27):	50	21
(Highland 1/1–3/27):	148	58

Coming Events:	**Ranges:**	
Green fruitworm 1st catch	41–173	9–101
Rebanded leafroller 1st catch	32–480	5–251
STLM 1st catch	73–433	17–251
Pear psylla adults active	2–121	0–49
Pear psylla 1st oviposition	25–147	1–72
McIntosh at green tip	24–165	4–74

NOTE: Every effort has been made to provide correct, complete and up-to-date pesticide recommendations. Nevertheless, changes in pesticide regulations occur constantly, and human errors are possible. These recommendations are not a substitute for pesticide labelling. Please read the label before applying any pesticide.

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