scaffolds
FRUIT JOURNAL

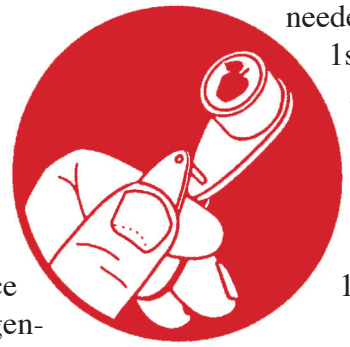
Update on Pest Management and Crop Development

April 30, 2007 VOLUME 16, No. 7 Geneva, NY

INSECTS

BACK ON SCREEN

ORCHARD RADAR DIGEST



❖❖ Starting today, we're once again publishing pest predictions generated by the Univ. of Maine's Orchard Radar model estimation service, provided to us by Glen Koehler for Geneva. This pest management tool uses commercially available weather data as an input for apple pest occurrence and development models taken from many established university and practitioner sources. It's offered as another perspective on what's happening in the orchard to compare against our own record-generated advisories and, of course, personal observations from the field. We'll be printing only some of the short-term arthropod events; the full Orchard Radar product range covers disease and horticultural events as well. The public sites available for anyone to use are located at: http://pronewengland.org/AllModels/DecisionModels.htm. Growers interested in exploring this service for their specific site may wish to contact Glen personally (gkoehler@umext.maine.edu).

Geneva Predictions:

Roundheaded Appletree Borer

RAB adult emergence begins: June 2; Peak emergence: June 16.

RAB egglaying begins: June 11. Peak egglaying period roughly: June 1 to July 15.

Codling Moth

1st generation 3% CM egg hatch: June 13 (= target date for first spray where multiple sprays needed to control 1st generation CM).

1st generation 20% CM egg hatch: June 20 (= target date where one spray needed to control 1st generation codling moth).

Lesser Appleworm

1st LAW flight, 1st trap catch: May 16.

Mullein Plant Bug

Expected 50% egg hatch date: May 22, which is 6 days before rough estimate of Red Delicious petal fall date.

The most accurate time for limb tapping counts, but possibly after MPB damage has occurred, is when 90% of eggs have hatched.

90% egg hatch date: May 26.

Obliquebanded Leafroller

1st generation OBLR flight, first trap catch expected: June 15.

continued...

IN THIS ISSUE...

Oriental Fruit Moth
1st OFM flight begins approximately: May 8.
Optimum 1st generation first treatment date, if needed: May 9.

San Jose Scale
First adult SJS caught on trap: May 23.

Spotted Tentiform Leafminer
1st STLM flight, peak trap catch: May 16.
1st generation sapfeeding mines start showing: May 27.
Optimum sample date is around May 28, when a larger portion of the mines have become detectable.

White Apple Leafhopper
1st generation WALH found on apple foliage: May 19.
❖❖

GENERAL INFO

GOOD FOR BEES NESTS

THE 'BEE' SIDE: HONEY BEES AND POLLINATION
(Nick Calderone, Entomology, Ithaca)

PART I: GETTING THE MOST POLLINATION FOR YOUR DOLLAR

❖❖ NOTE! Recent reports of high honey bee losses are real. The winter of 2006/2007 has seen a major spike in colony mortality. This has been seen before, but this time there appears to be an unidentified factor contributing to the die-offs. This syndrome has been dubbed Colony Collapse Disorder or CCD by some and it accounts for about 25% of all losses.

Tree fruits, small fruits, and many vegetable crops, especially many of the vine crops, all require pollinating insects for a successful harvest. Remember! Not only is pollination important for a high yield, it is just as important for fruit size, shape and sweetness. A number of insects pollinate crops; but, for several reasons, the honey bee is the most versatile pollinator. Honey bees are available in large numbers throughout the growing season, they pollinate over 90 commercial crops, they are easily transported by truck, and they can be easily distributed throughout large plantings. In addition, they restrict their foraging activities to a single species on any given trip to the field. Compared with other pollinators, honey bees are very cost effective. A single strong, two-story colony provides 15–25 thousand foragers.

How many colonies?

New York growers have traditionally used about one colony of bees per three acres for apple pollination. This number may have been adequate in small orchards visited by feral honey bees and by solitary bees and bumble bees from adjacent hedgerows and woods. However, wild honey bee populations have been greatly reduced by parasitic bee mites, and modern agricultural practices have eliminated many natural nesting sites for solitary bees and bumble bees. In addition, the flight range

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of solitary bees is not generally sufficient to ensure coverage of the interior portions of large plantings. Growers with large blocks of apples and other tree fruits may wish to increase the number of hives to one per acre. Modern cultivars with high blossom densities, such as trellised apples, also require more pollinators. If your fruit set has been lower than expected in the past, or your fruits are lopsided or misshapen, you probably need to use more bees. Remember, if your fruit set is too high, you can always thin, but if it is too low, you are just out of luck. Move bees into apples, regardless of variety, right before the king blossoms begin to open.

Special requirements

Most other crops are adequately served by a single strong colony per acre; however, some crops have special requirements. Red Delicious apples have a flower structure that is different from that of most other common varieties such as McIntosh. The anthers on Red Delicious flowers are widespread, and bees learn to insert their mouthparts between them to obtain nectar. Consequently, the bees do not contact the flower's sexual parts and pollination does not take place. Since it takes time for bees to learn to obtain nectar in this way, you can counteract this problem by using more colonies per acre to increase the number of inexperienced bees in the orchard. Up to two colonies per acre may be needed in large stands of Red Delicious apples.

Pollination of pears will probably always be a problem because pear nectar contains only about 15% sugar versus 40% for apples, dandelions, and yellow rocket. The answer is to move the bees into the center of the pear block when the pears are at 50% bloom. It will take some time for the bees to discover better sources farther away, and in that time, the pears may be adequately pollinated. An alternative is to use more colonies per acre, which will increase the number of bees foraging within the orchard. Sweet cherries should be pollinated soon after they open. Therefore, bees should be moved in the day before bloom. Since sweet cherries require a high fruit set for a commercially viable crop, and since they bloom early in the season when the weather is often unfavorable for foraging, two colonies per acre may be required. Research at the Geneva Experiment Station has shown that strawberries benefit substantially from having hives of bees in the field during bloom.

Hive Placement

To obtain maximum benefit for your pollination dollar, always select good locations for the bees you rent. A good location slopes slightly to the south, is protected from the prevailing winds, is dry, and has as much exposure to sunlight as possible. It is important that colonies of honey bees be kept in full sunlight in order to warm the hives rapidly in the morning and entice the workers out of the hives on chilly spring mornings. Entrances should face south to southeast whenever possible.

Keep colonies on pallets or cinder blocks to keep the bottom boards 4–8 inches above the ground. Hives with wet bottom boards will be cooler and have less foraging activity than dry colonies. A hive stand will also keep colonies above tall grass, which may shade or block the entrance. Place colonies in groups of 4–6 to take advantage of good locations. In large orchards and fields, groups of 10–20 hives can be used to take advantage of prime locations. It is best to locate hives near pollinizer rows where that consideration applies, such as with apples and sweet cherries.

Pesticides

Overall, pesticides are less of a problem to bees and beekeepers today than they were 10 and 20 years ago. Nevertheless, serious poisoning incidents still occur. It is important to read the pesticide label and to avoid using materials that are especially toxic to bees when there is a safer alternative available. Sevin (carbaryl), Penncap-M (microencapsulated methyl parathion) and Guthion (azinphosmethyl) are especially toxic to bees. There is also concern over the use of the neo-nicotinoids, but there is no hard evidence of any actual damage to bees at this time.

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You can eliminate most pesticide damage to bees by following a few simple rules. Never apply pesticides to flowers in bloom, as this will contaminate the pollen and nectar collected by the bees. Unfortunately, pesticides often drift onto non-target crops and weeds, and honey bees are poisoned when they ingest the contaminated pollen and nectar. Therefore, do not apply pesticides when there is a danger of drift. Keep flowering ground-cover plants mowed if you are going to spray in an orchard during the summer. Clover and dandelions are a common problem for bees on orchard floors. If mowing is not possible, use an herbicide for control.

Bees can also be poisoned when they collect water from sources that have been contaminated by drifting pesticides. Standing water in wheel ruts or old tires near your fields are prime sources of contaminated water. Provide a source of clean water near the hives. A wash tub filled with fresh water and straw works well. The straw gives the bees a place to land and drink without drowning.

You can minimize the dangers from drift by restricting spraying to periods when the winds are less than 5 mph. If possible, begin to spray in the evening, about an hour before sunset, because there is generally little wind at that time. Always use the largest droplet size possible when spraying, and check out the use of spray stickers to help minimize drift. Always dispose of empty pesticide containers in an appropriate manner. Remember! If too many bees are killed, your crops will not be adequately pollinated, and it may be necessary to rent more bees.

General Recommendations

Bees should be moved at night, and once the hives have been placed on location, they should be left there until the job is done. Moving bees in the daytime and moving them short distances at any time (less than 3 miles as the crow flies) will result in a serious loss of foragers and seriously damage the colony. Always contact the beekeepers if the need arises to move the bees. If you live in an area with known bear problems, use an electric fence to protect the bees. Keep nearby flowering plants mowed to reduce competition for the bees' attention.

The Beekeeper

I recommend establishing good working relations with several beekeepers to ensure that you have a ready supply of bees for pollination. Any individual beekeeper's situation may change over time, but if you work with several beekeepers, you should always have access to an adequate supply of colonies.

Availability and Pollination fees

During the past 5–6 years, beekeepers have learned a lesson all too familiar to most farmers: eventually, pests become resistant to pesticides. Today, honey bee colonies are often infected with strains of parasitic mites that are resistant to one or more pesticides, making control unpredictable or impossible. This fact has contributed to the high losses reported over the last several years. Almond growers in California are desperately trying to attract beekeepers for pollination. In addition to the $150.00+ offerings per colony, some growers are also willing to pay trucking fees to bring in bees from around the country. Growers should expect to pay a premium for colonies this year. The best strategy is to lock in your spring pollination needs towards the end of the previous year. Prices and availability are volatile, so a contract will help to ensure that you get the hives you are expecting, when you are expecting them and at the price you are expecting.

It is wise to make payment schedules contingent on colony strength, with stronger colonies commanding higher rental fees than weaker ones. A good method is to specify a base price to be paid for a colony of a specified strength—measured in terms of combs of bees and combs of brood. Bonuses and penalties can be based on deviations from those specifications. Remember! The best deal may not always be the cheapest deal.

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Expectations

Remember! Bees are an essential part of your crop production system, but they are only one part. In many ways, they are like the fertilizers and chemicals that you buy. Each is essential, but none of them, by themselves, can guarantee a crop. Many things influence the quantity and quality of your crop. One is the weather. Bees will visit flowers and pollinate only if they can fly. Cool, rainy, and windy weather will delay, slow, or stop flight, and the beekeeper cannot do anything about the weather. Excessive heat during the summer can cause problems with fruit set in certain crops, like pumpkins. Again, this is beyond the beekeeper's control. Be clear up front about your expectations concerning the strength of the colonies you rent, and satisfy yourself that you have received what you expected. This will eliminate misunderstandings down the road.

TIP

Planning a new orchard? Be sure to determine if your main cultivars are self-sterile—like McIntosh and Red Delicious apples—or, worse yet, self-sterile and inter-incompatible, like many popular cultivars of sweet cherries. If so, be sure to plant an adequate number of pollinizer cultivars. Be sure you select compatible pollinizers that bloom at the same time as your main variety. If you do not have pollinizers in your self-sterile stands, you can purchase compatible pollen and hive inserts, and let the bees you rent for pollination distribute the pollen from the hive to the blossoms.❖❖

PART II: Honey bees, Rental Fees, and Pollination Contracts

❖❖ Making a decent living from farming demands close attention to costs, and it is only reasonable that a grower should seek out the best price for each of the inputs that go into his or her crop production system. When it comes to honey bees, however, most growers understand the need for quality hives, but they don't have the expertise to assess that quality. Most growers don't look inside the hives to see what they are renting, and even if they did, most wouldn't know a good hive from a bad hive. The result is that the emphasis is usually on unit cost or number of boxes, rather than the actual value of the hive. This is not the best strategy for ensuring adequate pollination.

The best way to ensure the quality of the hives you rent is to spell out specifications for colony strength, payment fees and schedules, bonuses and penalties in a contract with the beekeeper. When you get the bees, take the time to inspect them to make sure that they meet the agreed upon specifications. You may need to hire an independent beekeeper to do this. The other thing you can do to ensure a sustainable supply of high quality honey bees for pollination is to pay well. That's right! Don't shop the bargain basements. It pays to pay top dollar for the top hives. If you make it possible for a beekeeper to make a living without cutting corners, you both win in the end.

A contract is less a matter of trust and more a matter of memories, which often fade after a few months. A contract should be drawn up several months before the bees are needed and should, at a minimum, address the following items:

1. Contact information.
2. Arrival/departure dates.
3. Delivery locations (if the beekeeper is not familiar with your operation, specify that a grower representative will meet the beekeeper at the delivery site and see to it that the bees are placed at the right locations using reasonably well maintained roads).
4. The % of hives the grower will inspect (beekeeper is encouraged to participate).
5. Bonuses for hives placed in areas that are hard to reach.
6. Accommodations for helping with trucks that become stuck.
7. Accommodations for legitimate problems, like truck breakdowns, that arise from time to time (ask that the beekeeper stays in communication with the farm starting at least a month before anticipated delivery date).

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8. Definition of a base unit and a fee for a base unit. A reasonable base unit is a colony with 6–7 deep frames of brood and 8 deep frames of bees.
9. Fee schedule:

0–3 frames brood = $0.00

4–5 frames brood and bees = 20% less than base

4–5 frames brood with a full box of bees = base rate

6–7 frames of brood and 8 combs of bees = base rate

8–10 frames of brood and full box of bees = 20% above base rate

10. In addition to the single story hive spelled out above, the colony should have an empty brood chamber and maybe a medium honey super. This will give the bees room to grow, and that's what makes them collect pollen.
11. Bear fences if supplied by the grower: deduct set amount per fence.
12. Bear fence if supplied by the beekeeper: add set amount per fence.
13. Responsibility for setting up electric fences, if needed, to protect against bear damage.
14. Responsibility for the cost of bear damage.
15. Payment schedule: e.g., pay 1/3 upon delivery, 1/3 within 2 weeks of departure, and 1/3 within the next 30 days.
16. Penalty schedule for late payments: e.g., if grower fails to pay on time, add 1/2% interest per month to the balance.

Remember! You can hold the beekeeper to a high standard if you pay a reasonable fee, and, in return, the beekeeper will be more than happy to do whatever it takes to keep your account. That is all part of sustainability.❖❖

IVORY TOWER

GO AHEAD, MAKE MY SPRAY
(Andrew Landers, Entomology, Geneva)

❖❖ Use of Sensor-controlled Precision Spray Technology with Tower sprayers for Improving Orchard Profits and Reducing Environmental Impacts

Ten progressive apple growers in Orleans Co., farming 1400 acres, have recently purchased, with the assistance of a 50% EQUIP grant, tower sprayers fitted with ultrasonic detectors. Sensor-controlled precision spray systems for orchard sprayers have been available for some years but recent developments by spray system manufacturers and supported by grower reports indicate improvements in this technology.

The growers are taking part in a research project with Dr. Andrew Landers of Cornell University and James Kingston of Orleans Co. SWCD to monitor the reduction in pesticide use and drift reduction.

A series of extension demonstrations have been organized for the 2007 growing season. Growers are encouraged to attend, to view the latest technology at work and to hear about the potential savings in pesticide use and the EQUIP grant. The first workshop will be held at 2:00 pm on May 17, at Mike Zingler's farm in Monroe Co., on Monroe-Orleans County Line Rd (between Kenmore and Lakeshore Rds. – See map next page.) ❖❖

HORTICULTURE

NIP 'EM IN THE BUD

PRUNING PEACHES
(Steve Hoying, Horticultural Sciences, Highland)

❖❖ Bloom time is the perfect time for pruning peaches. Earlier pruning risks crop reduction from subsequent frosts or freezes, which cannot be adjusted for with lighter than normal pruning. The later the pruning, the smaller the fruit size will be. The pruning window is relatively small and a large crew is needed for those with large acreages of peaches. Pruning should not be done in cool, wet conditions, since perennial canker can be problematic. At bloom, trees are starting to grow rapidly and pruning wounds heal before the fungus has a chance to become established.

Peaches bear on 1 year-old wood, so copious growth is needed annually to have the wood available to set a crop. Annual pruning, fertilization, and crop protection promotes annual growth. Pruning removes damaged wood and selects for shoots that will bear the best quality fruit. Shoots that are too small or too large produce peaches of poor quality. Select for pencil-sized wood, removing all wood that is small and spindly. It is critical that all the last year's small twigs that developed along the main scaffolds and trunk be removed completely to prevent canker infections.

Open-center trained tree height needs to be lowered annually. These trees should be lowered to about 8 feet in height to facilitate hand thinning and multiple picking. Simply bench cut to an outward-facing shoot with peach flowers at the desired height. Then thin out surrounding shoots, leaving only those oriented in the proper direction and of the proper size. Of course, cankered limbs need to be completely removed, and better early than later, since large cuts can further encourage winter injury and more canker. Pay particular attention to scaffolds with poor crotch angles. Remove these early before canker infection. Since peaches rarely lack for new growth, there should be sufficient replacement wood by the following year.

There are two schools of thought about how long fruit-bearing "hangers" should be left. One can shorten hangers, which will reduce the flower load and reduce the amount of hand thinning necessary, or allow hangers to remain long, and reduce the total number of shoots on the tree. There are advantages to both methods, but I prefer fewer, longer hangers.

Of all the planting systems available, the Perpendicular Vee (Fig. 1) for peaches has been very successful in New York, with high, early yields and excellent fruit quality. The advantages, in my opinion, heavily outweigh the disadvantages in NY, where canker and short life often limit the profitability of peach plantings. Early yield is very important in making a peach planting pay, and this system is among the fastest into production. The disadvantage of taller trees and some ladder work

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Figure 1. This is a Perpendicular-V pruned peach shortly after pruning. Note the permanent Y shape and renewable fruiting wood along its length. Trees are planted approximately 5 feet between trees and kept very narrow.

is overcome by early production, increased annual yield, and increased total production over the life of the planting.

For those of you considering Perpendicular Vee, here is a training "recipe" to get you started.

Pruning and Training Plan for Establishing the Perpendicular Vee Peach Training System

First Leaf

Before Planting:

Order peach/nectarine trees that have abundant buds along the length of the trunk. Trees should be smaller in diameter than usually used in Open Center planting systems. We recommend trees that are less than 1/2" in diameter and do not have any side branches. Seedling rootstocks such as Lovell or Bailey are appropriate for this planting system. Lay out the block so that tree rows run North/South.

At Planting:

Bury graft union, packing soil around each tree. If tree has sufficient buds along its entire length, head trees 18 inches above the soil line. Stub any remaining side shoots, making sure to leave 1 or 2 live buds on each shoot.

Early summer:

Control all secondary pests, especially oriental fruit moth and peach tree borer. Apply 1/4 pound Calcium nitrate per tree. Hang soap bars or fence block to deter deer.

Midsummer:

Pinch back shoots with too upright a crotch angle or ones facing into the tree row, making sure to leave those that have good crotch angles and face into the row middles.

Second Leaf

At normal Peach Bloom:

Prune when dry and expected to be free of rain for several days, which coincides with bloom of mature peach trees. Select two scaffolds approximately 12 inches above the soil line, each facing toward opposite row middles. These scaffolds should be about the same vigor and have flat crotch angles. Select ones that are separated along the trunk by approximately 3 inches, if possible. Tip scaffolds lightly, if needed, to balance length of each arm. If appropriate scaffolds are not available, select the best available scaffold, even if it faces into the tree row. Redirect growth back toward the tree row by choosing a side shoot facing in that direction. The result should be a tree with a basic Y shape.

Early summer:

Pinch back shoots that are excessively large along each scaffold arm. Remove all shoots that are growing upright on the inside of the Y arms. Maintain excellent pest control: insects, weeds, mammals.

Midsummer:

Repeat early summer training.

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Third Leaf

At normal peach bloom:

Continue to establish a Y-framework by stubbing back all limbs that are too large. Any shoot that is more than 1/2 the diameter of the main scaffold immediately above where it originates should be stubbed, leaving 2–3 live buds. Every shoot that is upright and on the inside of the Y-frame should be completely removed. Trees should be encouraged to carry a crop in the 3rd leaf if they have grown well and the crop load can be managed through selective stubbing of side shoots along each arm. Stub back up 1/2 to 2/3 of all side shoots to 2–3 buds. The remaining shoots should be evenly spaced along each Y arm and about 6 inches apart. Remove all apparent cankers.

Fruit Set to Pit hardening:

Fruit should be hand thinned 6–8 inches apart as early as possible and certainly before pit hardening. The earlier the thinning, the larger the peach and the earlier the ripening.

Midsummer:

Prune out all upright shoots along the inside of the Y-arms. Stub back all shoots that are too vigorous for their position to 2–3 buds. Remove all cankers.

2 weeks before harvest:

Repeat Midsummer.

Fourth Leaf

At normal Peach Bloom:

Continue to establish the Y-framework by stubbing back all limbs that are too large. Any shoot that is more than 1/2 the diameter of main scaffold immediately above where it originates should be stubbed, leaving 2–3 live buds. Completely remove every shoot that is large, upright and on the inside of the Y-frame. Head each scaffold arm at approximately 10 ft above the ground by cutting to an upright side shoot. For upright trees, choose shoots that face back into the tree row. In-facing shoots should be removed in the midsummer pruning. Upright growth should be encouraged for spreading trees. Remove all apparent cankers. Stub back approximately 1/2 the number of remaining side shoots to 2–3 buds. The remaining shoots should be evenly spaced along each Y arm and about 6 inches apart. Stubbed back shoots will provide fruiting wood for next year.

Before Pit hardening:

Trees should carry a full crop. Thin fruit to appropriate levels, depending on fruit size needs. Fruit is likely spaced 6 inches apart on each shoot.

Midsummer:

Keep interior of trees open by removing vigorous and upright interior growth.

2 weeks before harvest:

Repeat Midsummer.

Fifth to Twentieth Leaf

At Peach Bloom:

Pay particular attention to shoots in the bottom 1/2 of the tree along the scaffold arms. Prune to keep bottom shoots actively growing and continually fruitful. Be particularly aware of maintaining excellent light distribution throughout the bottom part of the tree. Head tops of scaffold arms maintaining approximately 12 feet in height and keeping tops very narrow and approximately in line with trunks by removing all large wood in the top facing in the row. Continue to renew shoots by stubbing back to 2–3 buds and spacing approximately 12 inches apart.

Before Pit hardening:

Thin peaches appropriate to fruit size and crop load. Space peaches 6–8 inches apart on each shoot.

Midsummer:

Keep interior of trees open by removing vigorous and upright interior growth.

2 weeks before harvest:

Repeat Midsummer.❖❖

DISEASES

KICK BACK, BACK

APPLE SCAB AND POST-INFECTION FUNGICIDES (PART II) (Wolfram Koeller, Plant Pathology, Geneva)

❖❖ The earliest scab infection periods are behind us, we are approaching tight cluster and/or pink, and decisions have to be made on how to continue the management of apple scab. Two options exist: To continue applying the purely protective EBDCs or Captan, either alone at their high label rates or mixed at a lower rate with Captan, at a tight spray interval not to exceed 7 days. Or, to apply a fungicide with post-infection activity in order to halt the infections that 'slipped through' the first protective sprays and, at the same time, to protect against the next following infections.

As summarized in Part I of this series, several classes of fungicides are labeled in NY and elsewhere for post-infection control of scab, but as also described, all of these various classes have developed or will develop resistance. For the past 15 years, the SIs (Nova, Procure, Rubigan) have been our 'mainstay' in providing 'kick-back' activity so crucial at the stage of pink and beyond. We started to test the development of resistance to the SIs shortly after they were introduced in 1987, and the pathway of how the scab fungus developed resistance to the SI fungicides available to us became more and more clear.

We found that individual strains of the fungus were 300-fold different in their responses to these fungicides, with very few strains highly sensitive and very few strains responding very 'robust'. After many years of orchard testing, manufacturers of the different SIs had settled on the recommended label rates of their products. Approximately 80% of the strains of the scab fungus were fully controlled, but 20% of the more 'robust' strains survived the treatments and could still reproduce. Over the many years of using the SIs, these 20% of strains had gained an advantage and slowly took over the orchards where SIs were applied. Less than 1% of these 'survivors' turned out to be the cause of control failures experienced after SIs had fulfilled their 'kick-back' promise for a decade. These strains were only marginally or not at all controlled at the recommended rates of the currently available SIs. We determined that a 20% level of such strains established in an orchard will cause a minimum of 15% scab on fruits at harvest. We consider this limit as the threshold of practical SI resistance.

In how many apple orchards have we reached or even exceeded this threshold of resistance? To answer this question, we modified our test procedures starting in 2002 to allow for an increased number of orchards to be tested. By 2006, we have tested a total of 77 commercial orchards, mostly from New York but also from the New England states and West Virginia. The results obtained from NY and 'out-of-state' orchards were the same.

Our test procedure allows us to distinguish between three levels of orchard sensitivities:

- BASELINE describes the sensitivity of the scab fungus at locations where SIs and other 'kick-back' fungicides were never used.
- SHIFTED describes the sensitivity of orchards that have not yet reached the level of practical resistance. Here, the SIs have not fully lost their former activity, but they must be applied at the highest rate permitted in their product labels.
- RESISTANT describes commercial orchards where the use of SIs contribute very little to the control of scab. In these orchards, the protective fungicide used in mixture with an SI, mostly mancozeb (Dithane, Manzeb, Penncozeb) at a low rate, will be responsible for most of the scab control achieved.

Where do we stand? The results are summarized in Table 1.

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Table 1. Status of SI resistance in 77 commercial orchards tested from 2003-2006.

Year	Baseline	Shifted	Resistant
2003	1	0	3
2004	1	5	11
2005	0	4	16
2006	0	5	31

The results describe a rather bleak status quo. According to these test data, 80% of the commercial orchards we tested had reached the level of practical resistance. Were the orchards we tested representative of all orchards where SIs had been in use? At this point in time, the question cannot be answered with certainty, because the majority of diseased leaf samples we tested originated from orchards where SIs were found to provide poor levels of scab control. In all cases, the observations made by respective growers were accompanied by a test result of 'SI-resistant'.

Can a judgment be made without tests of orchard sensitivities ? We had found in 1999 in an experimental orchard at our Experiment Station dedicated to the testing of 'soft' mite control, that 44 SI sprays in total applied over 11 years had resulted in the loss of scab control. The number of SI sprays made in orchards diagnosed SI-resistant ranged from 40 to 60.

Two major reasons call for caution in using this 'total-number-of-sprays' rule in scab management decisions:

- Over the past 20 years of SI availability, the management of many orchards has changed hands, and the SI history of these orchards is rarely known to current managers.
-
- SIs might have performed well in their mixture with a low rate of mancozeb, even though orchards had already reached the status of SI resistance. In these cases it must be assumed that the mixing partner mancozeb was sufficient to control scab in 'normal' seasons. Under more heavy infection pressure, however, mancozeb, and therefore the mixture, failed to control scab.

We have experienced this latter scenario in 2006. SIs in mixture with mancozeb had been used in an orchard four times per season since their introduction in 1987, until a very severe control failure on McIntosh trees was experienced during the early part of the unusually wet season of 2006. Sensitivity tests showed that the scab strains in this orchard had even surpassed the level of SI resistance. Very apparently, mancozeb in mixture with the SIs had provided adequate control of scab until a control failure was experienced during an unusually 'heavy' scab year.

The only current advice we can offer is that whenever SIs in mixture with mancozeb have shown 'signs of weakness', SIs should not be used during the next season, and that leaf samples with scab lesions should be submitted for sensitivity tests.

Everything said above applies only to the three SIs currently available: Nova, Procure and Rubigan. Fungicide manufacturers are currently developing a 'second generation' of SIs with scab activities. The first fungicide of this new SI generation is the 2F formulation of Indar, which was approved by EPA for the control of apple diseases, including apple scab, for this season of 2007. The DEC has declined to grant a NY Indar label for 2007, but most likely, Indar will be available in New York at the start of the 2008 season.

Why is this 'second generation' of SIs important? The answer is relatively simple. They are much more active against the scab fungus, and at their recommended rates they will still control many of the scab strains no longer affected by the 'first generation' of SIs. During several years of evaluations in our SI-resistant Station orchards, their performance advantages were verified. In Table 2, the performances of Nova and Rubigan were compared with the performance of the new Indar 2F formulation. All SIs were applied at their recommended label rates in mixture with Dithane at the low 3 lbs/acre rate.

continued...

Under the extremely high infection pressure during 2006, where most fruits had prematurely dropped prior to harvest, and where fungicides were deliberately applied 48–96 hours post-infection at half-inch green and petal fall, Nova and Rubigan in mixture with Dithane failed to provide scab control superior to Dithane used alone at the same spray schedule. Indar provided a significantly higher level of fruit scab control than Dithane alone or even in mixture with Captan. Although leaf scab control at harvest was not improved above the level of Captan plus Dithane, the data show that the more active 'second generation' SI Indar can be expected to outperform the less active SIs currently available, even in orchards where practical resistance to these SIs has been established. The 2006 results confirm the experiences made during several years of performance tests.

Table 2. Fungicide performances at harvest in a SI-resistant McIntosh test orchard.

Treatments	Fruit scab (%)	Leaf scab (%)
Check	100	94
Dithane	58	57
Captan + Dithane	48	29
Nova + Dithane	46	44
Rubigan + Dithane	46	44
Indar + Dithane	29	32

Two or perhaps three more 'second generation' SIs are under various stages of development for the control of apple diseases, including scab, and we have to examine their future value in orchards already resistant to the current SIs. The crucial question will be, whether and how fast they will drive SI resistance to an even higher level. This question is under current investigation and cannot be answered at present.

Part III appearing in the next issue of Scaffolds will examine the value of post-infection alternatives. In a quick preview: Dodine (Syllit) could serve as an alternative in some orchards, but we cannot recommend use of Syllit without knowledge of the orchard sensitivity to dodine. The strobilurins Flint and Sovran remain active in the management of scab, but their 'kick-back' activity, which was never as pronounced as originally for the SIs, has started to erode in orchards where they have been used for several years. The APs Scala and Vangard provide 'kick-back' action, but to carry this advantage over to improved fruit scab control at harvest remains an unresolved question. Stay tuned. ❖❖

PHENOLOGIES

Geneva:

	4/30	5/7 (Predicted)
Apple(McIntosh):	early tight cluster	pink
Apple(Red Delicious):	1/2" green	tight cluster–pink
Pear:	green cluster	white bud
Sweet cherry:	early white bud	bloom
Tart cherry:	bud burst	white bud
Peach:	1/4" green	bloom

Highland:
Apple (McIntosh, Ginger Gold, Empire): early pink
Apple (Golden Delicious, Honeycrisp, Red Delicious): tight cluster
Pear (Bartlett/Bosc): white bud
Peach (early): full bloom
Peach (late): bloom
Plum (Stanley): 20% bloom
Plum (Italian): bud burst
Apricot: 50 petal fall

UPCOMING PEST EVENTS

	43°F	50°F
Current DD accumulations (Geneva 1/1–4/30/07):	227	101
(Geneva 1/1–4/30/2006):	286	116
(Geneva "Normal"):	251	120
(Geneva 1/1–5/7/2007, Predicted):	288	131
(Highland 3/1–4/30/07):	170	79

Coming Events:	Ranges(Normal±StDev):	
McIntosh at tight cluster	138–279	85–121
Red Delicious at half-inch green	137–226	72–98
European red mite egg hatch	157–358	100–168
Green fruitworm flight peak	64–255	35–91
Pear thrips in pear buds	137–221	50–98
Spotted tentiform leafminer 1st catch	73–433	40–114
Spotted tentiform leafminer 1st oviposition	141–319	58–130
Oriental fruit moth first catch	129–587	80–204
Obliquebanded leafroller larvae active	149–388	64–160
Pear psylla first egg hatch	111–402	60–166
Redbanded leafroller 1st flight peak	180–455	101–191
Rose leafhopper nymphs on multiflora rose	188–402	96–198

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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