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Update on Pest Management and Crop Development
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COMING EVENTS

	43°F	50°F
Current DD* accumulations		
(Geneva 1/1-4/2):	60.3	20.6
(Geneva 1/1-4/2/2017):	99.7	37.2
(Geneva "Normal"):	84.0	32.7
(Geneva 1/1-4/9, predicted):	69.2	21.8
(Highland 1/1-4/1):	110.8	37.4

Upcoming Pest Events:	Ranges (Normal +/- Std Dev):	
Green fruitworm 1st catch	50-148	12-68
Pear psylla adults active	31-99	8-34
Pear psylla 1st oviposition	40-126	11-53
McIntosh silver tip	63-107	21-42
McIntosh green tip	99-145	38-63

*[all DDs Baskerville-Emin, B.E.]

Pest Focus

Highland: Green Fruitworm 1st catch 3/28
Rebanded Leafroller 1st catch today (4/2)

TRAP CATCHES (Number/trap)
Geneva

	4/2
Green Fruitworm	0.0
Redbanded Leafroller	0.0
Spotted Tentiform Leafminer	0.0

Highland (Peter Jentsch)

	3/26	3/28	4/2
Green Fruitworm	0.0	0.5*	1.0
Redbanded Leafroller	0.0	0.0	2.0*
Spotted Tentiform Leafminer	0.0	0.0	0.0

* 1st catch

[Section: INSECTS]

PREPARE YE THE WAY: EARLY PSYLLA MANAGEMENT PLANNING

(Peter Jentsch, Entomology, Highland; pjj5@cornell.edu)

[Box text: PSYLLA, CHAPTER & VERSE]

Recent snow in late March provided a welcome delay in bud maturity. With temperatures beginning to move into the mid- to upper 50s, the pear psylla adult will be

increasingly active throughout the Hudson Valley as we move through the pre-bloom period.

Egg Hunt

Today, 2 April, bud counts for psylla eggs turned up the first eggs of the season: 2 per 25 Bartlett buds inspected. As oviposition begins and builds over the coming weeks, management to inhibit intensive egg laying should begin. Considerations for management in southern blocks and orchards along the Hudson River provide a timely window as dry weather and orchard access permits. Cooler night temps and rain are expected later in the week with mild temps and dryer conditions forecast over the weekend.

In the overwintering stage, the adult lingers about the orchard and woodland edge from fall, through the winter and into spring. Adults are often seen in flight during the warm hours of the day, with increasing movement of woodland adults into the orchard over the next few weeks. After mating, females begin to produce eggs for the first of three to four generations, beginning with nymph hatch from late March through June.

Strategies to manage pear psylla include pre-bloom applications of ovipositional deterrents, ovicides and insecticides aimed at the adult and nymphal populations. Early management should begin upon the first signs of eggs. To delay the insect from laying eggs, Surround WP or oil at 1–3% can be used, based on green tissue presence and temperatures both before and after the application, as both act as a barrier film to reduce egg laying. Delaying oviposition of the adults buys time for a greater number of overwintering psylla to enter the orchard from the hedgerows and woodland for a later adulticide application. It also allows for the complement of eggs being deposited to be delayed, thus synchronizing the emergence of the psylla nymphs for a directed application targeting this life stage.

In 2016, the use of two applications of oil, at 1 and 2%, were made on the 15th of March and 1st of June to demonstrate the effectiveness of these applications at reducing egg and nymph presence over the early part of the season. The resulting summary collected from this trial is shown in Fig. 1. From this study, we see a dramatic reduction in both nymphs and eggs using two applications of 1% and 2% oil. The use of Surround WP at 50lb/A, used exclusively during the pre-bloom stage,

has provided excellent reduction of the 1st generation nymphs through reduced egg laying. with no observed clay residue on fruit at harvest.

We often think a single application of oil and a pyrethroid will "do the job" during the pre-bloom period. This data suggests that the use of oil alone showed a significant difference in reducing eggs on the tree and emerging nymphs in 2016.

As the adults reside both in the orchard and also migrate into the pear blocks, it would be wise to delay applying an insecticide until migration of adults is complete, and to consider the use of oil in two applications followed by a targeted adult insecticide as we move toward bloom. Pyrethroids are known to have reduced efficacy when used during warm temperatures above 65°F. As a cautionary note, in field studies we have seen most pyrethroids completely fall down in psylla management, likely due to the insects' ability to detoxify this class of insecticides as temperatures increase. Cool weather provides the conditions to optimize the use of pyrethroids. However, the use of these insecticides over the past 20 years has decreased pear psylla susceptibility to some pyrethroids such as Asana (esfenvalerate) and Warrior

(lambda-cyhalothrin). Their use should be limited and used only during periods of cool temperatures.

Bee Wise

As pears bloom earlier than apples, pollinators tend to move to pears well before their shift over to apples. With this in mind, we know that the pyrethroid class can act as an insect repellent. Given that the honeybee is not particularly fond of pear flowers relative to other tree fruit blossoms, considerations should be made to optimize bee attractiveness to pear blossoms during pollination. To best achieve pollination, it might be best to restrain from using pyrethroids during the period from white bud to bloom so as to reduce bee repellency.

Pear Management Options

The advantages of using oil to control this insect are many. Oil is still a relatively inexpensive material for which there has been no mechanism seen for resistance development by the insect. It provides a degree of egg laying deterrence to treated buds and wood lasting a week or two, depending on rate used and weathering effects. Higher rates would be applied at the dormant stage initially, using one spray of 3% oil, or two of 2% until green cluster. This rate will also

reduce overwintering populations of San Jose scale, European red mite, pearleaf blister mite, and Comstock mealybug. If you begin at swollen bud, one spray at 2% or two at 1% up to white bud would suffice. Contacting the adult with oil droplets will cause mortality, while applications over the top of the egg will reduce adhesion, often causing them to dislodge from the tree. Oil applied prior to oviposition acts to delay and synchronize egg laying later into the season, producing subsequent emergence of the nymphs for a concentrated management approach using a single insecticide application at white bud or later. Negative impact of oil applications has been observed in the form of enlarged lenticels on developing stems, which may have an effect on plant respiration.

Ovicides can also be employed to kill the eggs prior to hatch. The use of Esteem and Centaur work as insect growth regulators (IGRs) to inhibit development of various life stages. Esteem 35WP, used prebloom to kill the egg stage of psylla and reduce the viability of eggs laid by treated adult, should be applied prior to sustained egg laying with 0.25% v/v horticultural spray oil. Esteem may be applied once at delayed dormant to "pink stage" at 5 oz/A, or two applications at delayed dormant to "petal fall" stage at 4-5 oz/A, as a tactic for

both psylla reductions and as a resistance management strategy [**Ed. Note:** Please see "Erratum" under Chem News section in this issue]. Remember, its mode of action is as an ovicide, so it will not reduce the adult or nymph population directly; it is most effectively used if the material is on the wood or foliage prior to the eggs being deposited.

Using an ovipositional deterrent (oil, Surround WP) is a prerequisite to at least two follow-up strategies. One option, upon the completed migration of adults into pear orchards, is the use of an adulticide made to kill the adults, before significant eggs have been laid. Adulticides would be employed this season from mid- to late April to significantly reduce the adult population. The choices for managing adult psylla include the neonicotinoids Actara 25WDG at 5.5 oz/A and Assail 30SG at 4–8 oz/A; and the pyrethroids, Pounce 25WP at 12.8–25.6 oz/A; Asana XL 0.66EC at 7.3-12.8 fl oz/100 gal or 9.6–19.2 fl oz/A (from dormant to white bud stage; postbloom rates are lower); Proaxis 0.5CS at 2.6–5.1 fl oz/A; Danitol 2.4EC at 16–21.3 fl oz/A; or Warrior II at 1.26–2.56 fl oz/A. Multiple applications may be needed to achieve optimum early season control.

The economics of management is a driver in decision-making for pear production. Surround WP is most effective at the highest labeled rate of 50 lbs/A (roughly $1.00/lb), costing about $50/A. Two to three applications during the pre-bloom and petal fall period have shown to be a viable approach for early psylla management. Although it does not kill the adult, it will inhibit egg laying as long as there is sufficient material on the foliage and stems to keep adults from the tree. In our trials, the use of a single prebloom application of Surround at 50 lb/A was comparable to a single 2% application of Damoil in reducing oviposition when applied at the same time. Yet as the season progressed, the Surround treatment performed better in reducing nymph presence on the foliage during later assessments compared with other pre-bloom choices.

The stratification or layering of the kaolin clay, the active ingredient of Surround, builds on the limbs to maintain the product on the tree. Using early season applications through petal fall has the additional benefit of controlling plum curculio along with reducing egg laying from the 1st generation of psylla adults. Surround has not been shown to be toxic to the insect and, as such, is an important tool for use in resistance management strategies for this insect. For additional

information on this topic review the Mar. 26, 2012 Scaffolds article addressing the early Surround WP followed by 1% oil strategy.

Ending the use of Surround WP at petal fall will minimize the overall cost of management using this product while reducing the potential for clay residue remaining on the fruit at harvest. However, pears will require continued management of pear psylla throughout the remainder of the season. We have found the use of 1% oil at a two-week interval to provide sufficient control of the nymph population by reducing both egg laying and nymph survival. See 2015 RESULTS OF INSECTICIDE AND ACARICIDE STUDIES IN EASTERN NEW YORK; Hudson Valley Laboratory, Highland, NY pgs 25-30.

[Section: DISEASES]

2018 APPLE FUNGICIDE UPDATE FOR NY

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[Box text: CHOOSING 'CIDES]

Fungicide selection for apple disease management may be complicated, but it is doable. Complicating factors include pathogen resistance to older fungicides that have been rebranded, pre-mix products of multiple fungicides, an abundance of new chemistries in the same fungicide group (a FRAC group is made up of similar modes of action determined by the Fungicide Resistance Action Committee), and the potential for injurious tank mix combinations during thinning timings. The prevalence of practical fungicide resistance in commercial populations of *Venturia inaequalis* (the apple scab pathogen) seems to have subsided in recent years. This is likely due to widespread use of multi-site (mode of action) protectants and inclusion of the succinate dehydrogenase inhibitors (SDHI; group 7) in rotational programs with products from several other fungicide classes. While selecting the right fungicides has become more complicated, it is now possible to rotate more than four fungicide classes in a single season without considering multi-site protectants. Although resistance to QoI (group 11) and DMI (group 3) fungicides in populations of *V. inaequalis* may be widespread throughout the Northeast, continuing to use these fungicides in your apple fungicide program will 1) capitalize on their high level of activity against

powdery mildew and summer diseases, and 2) reduce selection for resistance to the new SDHI (group 7) fungicides.

In 2018, the paradigm of marketing products of pre-mix fungicides continues to wane as more single-fungicide products are being developed by the agrichemical industry. However, it is not known whether the forthcoming fungicide chemistries will be marketed alone or in combination with another fungicide. Some pre-mix products have become recently labeled for use in NY, but were developed and validated several years prior. There are some products that will be new to growers in 2018. With each new fungicide product, the use of low volume applications combined with the complexity of tank mixes during thinning, and incompatibilities with existing products will continue to present issues. Below we present an update on the newest and most important fungicide products and provide our perspectives on the use of existing products.

Available fungicides

Dodine (syllit)

Syllit (dodine) can only be applied twice prior to pink according to the label. However, applications after

bloom are still allowed on pears. There are concerns that the use of Syllit after pink may predispose selection for resistance or increase the chance of injury in complex tank mixes. We haven't been able to find an isolate with dodine resistance in research or commercial plantings in many years, and there appear to be no more *V. inaequalis* (apple scab) populations with practical resistance to dodine. We have a few *V. inaequalis* isolates from research orchards in Geneva that can grow in the presence of dodine in culture. However, these isolates seem to possess multi-drug resistance and the orchard populations as a whole seem to be sensitive to Syllit. Moreover, Syllit provided excellent control in this orchard for the last three seasons. To avoid practical resistance, Syllit should be applied in combination with mancozeb and applied no more than twice. The label now also requires mixing with either mancozeb or captan, but mixing with captan increases the risk of phytotoxicity. If there are heavy rains prior to pink, Syllit may be a good choice for high-inoculum orchards, as it has some post-infection utility even in orchards that were once shifted towards resistance. Since copper is often applied at silver/green tip to suppress fire blight inoculum, Syllit plus mancozeb could be applied from late green tip to tight cluster. If powdery mildew is a concern, Syllit may not

be a good choice at tight cluster, as it has no activity against mildew. Syllit is not very effective on rust diseases, but including mancozeb as a tank-mix partner may help in orchards with light rust pressure.

Captan and Mancozeb

Combinations of mancozeb and captan applied on a 5–7-day schedule have been popular to manage primary apple scab from green tip to 2nd cover. The combination referred to as "captozeb" usually consists of the 3 lbs/A of Mancozeb (75% active) mixed with 2.5 lbs/A Captan (80% active). These contact fungicides are protectants and must be applied before rains, or at least before the end of an apple scab infection period. If this combination is applied in the rain, there will be some residual activity after the rains end. The captozeb combination is effective for apple scab, but captan and mancozeb are ineffective on powdery mildew. Moreover, the 3 lb/A rate of mancozeb may not be effective against cedar apple rust in high-inoculum orchards. In this instance, other single-site fungicides would be needed to manage powdery mildew and cedar apple rust.

As the orchard progresses into bloom, captan should be used with caution because it is phytotoxic if

absorbed into plant cells. By the time apples are in petal fall, the risk of captan injury will be highest. At this time, tank mixes become increasingly complex due to the need to manage insects and diseases, provide foliar nutrients, and manage crop load. Growers are trying to reduce application volume to reduce the number of times they need to refill their sprayer and reduce water use. Reduced water volumes also greatly increase the risk concentrated captan deposits on leaves. Adjuvants, oils, and other tank mix partners are needed to improve the efficacy of agricultural chemicals. These materials can enhance the uptake of captan and increase the chances that it will penetrate the cuticular layer of leaves and fruit. Captan uptake into young susceptible fruit tissues can be further enhanced if applications are made under slow drying conditions on an overcast day, in the early morning, in the late evening, or during a light rain. Although there have been no reports of captan-related injury in the last two years, we still recommend that growers curtail applications of captan at petal fall and first cover when the cuticles of apples leaves and fruit are not fully developed.

Many of the newly released fungicides are formulated in organic carriers and haven't been evaluated in the

context of tank mixes with captan and penetrating surfactants and in low volume applications (<50 gal/A). Therefore, captan compatibility problems under high risk conditions may be largely unknown for many of the newer fungicides. If mancozeb is selected over captan after bloom, it will be important to also avoid any pre-bloom applications of mancozeb or Polyram that exceed 3 lbs/A, to remain in compliance with labeling restrictions. If rates of mancozeb higher than 3 lbs/A are used at any time during the early season, the label will not allow post-bloom applications of mancozeb.

SDHI fungicides

There are many SDHI fungicides registered for apples (Table 1) and more are forthcoming. SDHI fungicide products are either marketed alone or pre-mixed with another fungicide belonging to the QoI, AP (anilinopyrimidine), or DMI fungicide classes. SDHI fungicides in general have a high level of activity against apple scab and a moderate level of activity against apple rust diseases and powdery mildew. Because the AP fungicides are typically more effective against apple scab in the early season when the weather is cooler, and have no activity against powdery mildew and rust diseases, it would be best to apply pre-mix products with AP fungicides prior to bloom. SDHI fungicide

products with QoI mix partners are more effective against powdery mildew and rust diseases. Hence, these pre-mix products are best applied from bloom to first cover. Since the SDHI plus QoI pre-mix products also work well for many summer diseases, using them at first cover and in the final pre-harvest cover is often advisable. While there are concerns about QoI fungicide resistance in NY and New England, the performance of the SDHI plus QoI pre-mix products is not often affected by the presence of QoI-resistant apple scab or powdery mildew. In our research orchards, where there is documented QoI resistance to apple scab and powdery mildew, QoI/SDHI pre-mix fungicides seem to provide the same level of control as their SDHI counterpart. Irrespective of the resistance status, one should include 3 lbs of mancozeb (a multi-site contact fungicide) with all SDHI fungicides to preserve the life span of this fungicide class. Mancozeb is often preferable to captan, given the concerns regarding captan injury at petal fall and 1st cover. Beyond first cover, SDHI fungicides can be safely combined with captan in summer sprays. Always use caution when mixing SDHI fungicides, since nearly all SDHI fungicide products are petroleum-based formulations, which could slightly enhance the uptake of captan under slow drying conditions. Table 1

summarizes the various features of the current and forthcoming SDHI fungicide products.

Table 1. Features of current and forthcoming SDHI fungicide products.

Trade name (Manuf.)	Fungicide Chemistries (FRAC group)	Disease efficacy at currently labeled field rates	Registration Status (Restricted)	Use on Long Island
Fontellis (DuPont)	SDHI (7)	High: apple scab, Low to Moderate: Rust and Mildew	Special Local Need	No
Merivon (BASF)	SDHI (7) + QoI (11)	High: apple scab, Moderate to High: Rust and Mildew	Restricted Use	No
Sercadis (BASF)	SDHI (7)	High: apple scab, Moderate to High: Mildew,	Restricted Use	No

		Low: Rust		
Pristine (BASF)	SDHI (7) + QoI (11)	High: apple scab, Moderately High: Rust and Mildew	Not restricted	Yes
Luna Tranquility (Bayer)	SDHI (7) + AP (9)	High: apple scab, Moderate to High: Mildew, Low: Rust	Restricted Use	No
Luna Sensation (Bayer)	SDHI (7) + QoI (11)	High: apple scab, Moderate to High: Rust and Mildew	Restricted Use	No
Aprovia (Syngenta)	SDHI (7)	Exceptionally High: apple scab, Low to moderate: Rust and Mildew	Not-restricted	Yes

QoI or strobilurin fungicides

The QoI or strobilurin fungicides provide a high level of activity against apple scab, apple rust diseases, powdery mildew, sooty blotch and flyspeck, and summer fruit rots. Unfortunately, resistance to QoI fungicides has been documented in MI, IN, NY and several New England states. The development of resistance may appear gradual at first, but can quickly progress to a near complete loss of effectiveness. In recent years, we've obtained some QoI resistant isolates of *Podosphaera leucotricha* (apple powdery mildew), and *Colletotrichum fioriniae* (bitter rot), *Botrytis cinerea* (gray mold), and *Botryosphaeria dothidea* (white rot) from NY apple orchards or apple samples sent in for diagnosis. Given the possibility of QoI resistance present in NY orchards, evidenced by occasional serendipitous identification of isolates as part of routine diagnostic work, it may be best to limit stand-alone QoI fungicide products to only two applications each season. I would save these materials for applications from petal fall to 2nd cover; they still perform well against apple powdery mildew and the ascospore inoculum of fly speck sooty blotch. When possible, consider using a SDHI/QoI fungicide pre-mix product such as Merivon, Luna Sensation, or Pristine instead of a stand-alone QoI fungicide product. The

SDHI/QoI pre-mix fungicides would provide the same activity as a standalone QoI fungicide, but with less risk of resistance development.

DMI fungicides

Resistance to DMI fungicides (Rubigan, Rally, Indar, Rhyme, and Inspire Super) in populations of *V. inaequalis* (apple scab) is widespread in the northeastern United States. Resistance to this class of fungicides is rate-dependent and gradual, meaning that resistance may be overcome by higher rates of DMI fungicide products. Selecting DMI chemistries with higher intrinsic activity against apple scab or apple powdery mildew is the key to overcoming pathogen resistance and achieving the best control. For example, difenoconazole, a DMI fungicide in the product Inspire Super, is so effective at blocking ergosterol biosynthesis in *V. inaequalis*, that resistant isolates do not have the metabolic capacity to overcome the fungicide. Simply put, if Inspire Super is applied at the highest labeled rate, the effective dose of difenoconazole is greater than what *V. inaequalis* can tolerate, even in populations with a high level of DMI resistance. Even if we can beat the fungi with a more effective fungicide, DMI fungicides should still be used with extreme caution, and not used for post-infection activity or used

on cultivars that are highly susceptible to apple scab (e.g., McIntosh). Products containing the highly-soluble DMI fungicides fenarimol, myclobutanil, and flutriafol (Rubigan, Rally, and Rhyme, respectively) are the least intrinsically active against apple scab and mostly likely lead to field failures in resistant populations. However, one can still use the high-solubility DMI fungicides and mitigate practical fungicide resistance. In research trials in Geneva, we've been able to avoid product failures due to DMI resistance with the newest formulation of flutriafol (Rhyme) applied at the labeled rate with Mancozeb (75%) at 3 lbs/A.

Since the fungicide application timings are the same for both apple scab and apple powdery mildew, it is likely that populations of *Podosphaera leucotricha* (apple powdery mildew) in the same orchard also have DMI resistance. Since it is extremely difficult to grow apple powdery mildew in culture and there are no known genetic mutations conferring resistance, we cannot test for DMI resistance in this pathosystem. At best, we can only make inferences from reported commercial product failures and the need to use higher rates of DMI fungicides to achieve control in research trials.

Practical resistance to DMI fungicides in apple powdery mildew is most commonly observed in programs where low solubility DMI fungicides are used. These include fungicides like difenoconazole (Inspire Super) and fenbuconazole (Indar 2F). By comparison, highly soluble DMI fungicides like myclobutanil (Rally) and flutriafol (Rhyme) are still highly effective against DMI-resistant powdery mildew, but now require higher rates. The label for Rally 40 WSP has changed over the years to allow rates as high as 10 oz/A. While growers achieved excellent control of powdery mildew with Rally at 4 oz/A when this fungicide was first introduced, 5 or 6 or even 8 oz/A are now needed to get the same level of mildew control. Using myclobutanil (Rally) at rates above 6 oz/A at petal fall and first cover (two critical mildew timings) may be effective, but could result in undesirable plant growth regulator effects. These effects would include smaller length/diameter ratios (i.e., less true to type fruit) and/or slightly decreased fruit thinning. All of these concerns aside, the DMIs are still some of the most effective materials for managing apple powdery mildew and apple rusts.

Summary

Selecting the right fungicides for your season apple program can be challenging and confusing. There are

now more options, considering the number of new products, new product names, mixes of fungicides, and more classes of fungicides than there were 10 years ago. There is fungicide resistance in more pathosystems, and growers are adding more things into the spray tank to ensure success in apples. Fortunately, every fungicide product registered has some utility against some disease. Hence, there are few truly bad choices or poor decisions that one can make when selecting fungicide products in 2018. The best plan involves the use of protectants early against apple scab, the use of single-site fungicides from tight cluster to harvest to manage multiple diseases, avoiding captan during thinning, and making a few applications from each class of fungicides throughout the season to manage fungicide resistance.

[Section: CHEM NEWS]

ERRATUM: OMISSION OF ESTEEM IN PEARS SECTION OF RECOMMENDS

(Art Agnello, Entomology, Geneva; ama4@cornell.edu)

An error in the database update for the Tree Fruit Pest Management Guidelines resulted in the inadvertent omission of Esteem 35WP as an option for

pear psylla (Table 12.1.1). Please note that the following entry should be present at the Swollen Bud, Green Cluster, White Bud, and Petal Fall sections of this table:

Product/IRAC	Rate	PHI	REI	Efficacy	Comments
Esteem 35WP/7C	4-5 oz/acre	45 days	12 hrs	High	12.2, 12.2b, 12.5

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