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Post-Petal Fall Insect Pests on the Horizon

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As with many other biological events, insect development responds positively to warmer conditions, so now that we are starting to accumulate some heat units, management decisions for most major pests will tend to need addressing on a fairly predictable schedule. The following is a long-view update of some of the traditional crop protection scenarios during this period.

Plum Curculio

Curcs have only so much egg-laying activity programmed into their development, and its duration is directly related to the temperature. The warmer the post-petal fall period is, the quicker they finish, so the long-term forecast will be instrumental in determining how many cover sprays might be needed after petal fall to adequately protect the region's orchards until the ovipositing is finished. Coverage should remain in place until 308DD have accumulated since petal fall on your site. This can be easily determined using the Plum Curculio model on NEWA. Where additional applications against curcs are still warranted, some effective options included Imidan, Actara, Avaunt, Exirel, Verdepryn, Besiege, and Minecto Pro.

For apples, if you additionally have **Rosy Apple Aphid** colonies active in your trees and want to guard against the buildup of foliar colonies later, consider an application of a material having good activity on this species (e.g., Actara, Admire Pro, Assail, Exirel, Leverage, Minecto Pro, Sivanto Prime).

European Apple Sawfly

Traditionally confined to the eastern half of the state, the adults start laying eggs on or near newly set fruitlets at petal fall, so the plum curculio applications will have done double duty against this pest as well. Effective options include Imidan, Actara, Altacor, Avaunt, Exirel, Voliam Flexi.

Obliquebanded Leafroller

We expect to start seeing obliquebanded leafroller adult flight very soon in Eastern NY. Depending on your location, larvae from the overwintering generation should be able to be found now in various stages of development. Pheromone traps should already be out in problem apple blocks, to fix the date of first emergence in your specific area. Recall that we recommend sampling at 600 DD (base 43°F) after the first adult catch, to determine the need and timing for treatment. For problem

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orchards with a reliable OBLR history where sampling is generally not needed, egg hatch (which equates to the first occurrence of susceptible larvae) occurs more or less 350 DD after the 1st adult catch. Once again, the Apple IPM Insect Models Website can help you zero in on these events in your specific area.

In orchards not too removed from petal fall and containing large larvae, an application of Intrepid, Proclaim, Rimon, Grandevo, or a B.t. product (e.g., Agree, Dipel, Deliver, Javelin) at this time will help diminish the population for better management during the summer. Although Altacor, Delegate, or Exirel are also very effective against OBLR, it would be advisable to save these big guns for the summer generation larvae, which are more of a direct threat to the developing fruits.

Obliqebanded leafroller larvae. Photo: Todd M. Gilligan and Marc E. Epstein, CSU, Bugwood.org

European Red Mite

Mite populations should be starting to build with the onset of warm temperatures, and adults may already be present in some warmer areas, which means that they'll be laying summer eggs that will hatch into potential problems before long. If you failed to take advantage of any pre-bloom opportunities for early season oil or miticide applications, it's not too late to use one of the preventive materials such as Savey/Onager, Apollo, Agri-Mek, Nealta, Portal, or Zeal in problem blocks or where you may have noted ERM eggs.

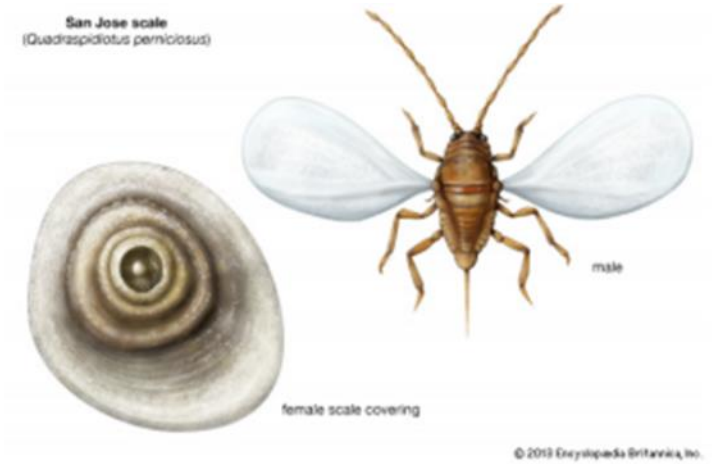
In situations where European red mite pressure or the crop's sensitivity to them haven't necessarily justified an early season treatment with any of the above options, this is the time of year when a summer oil program also might be considered as an alternate preventive approach. Our field research trials have shown the effectiveness of using a highly refined oil in a seasonal program to control mites throughout the summer. Some examples of these products are PureSpray Spray Oil 10E, BioCover UL, or PureSpray Green (all from Petro Canada), Stylet-Oil (JMS Flower Farms), and Omni (an ExxonMobil product formulated using Orchex 796 and distributed by Helena); others are available, such as Damoil (Drexel), Saf-T-Side (Brandt Consolidated) and Mite-E-Oil (Helena), although we haven't tested all brands.

Our approach is to make three applications, on a preventive schedule, immediately after the petal fall period, before mite populations have a chance to build. The first application can be any time from petal fall to 1–2 weeks later, followed by two additional sprays at 10–14 day intervals. The oil is not concentrated in the tank, but rather mixed on the basis of a rate per 100 gallons of finished spray solution; in most cases, we recommend 100 gal per acre. A rate of 1–2 gal/100 should maintain control of most moderate populations. Don't apply without leaving at least a 10–14-day interval before or after a captan spray, or an application of any thinning materials.

San Jose Scale

Minute SJS adult males emerge in the spring from beneath scale covers on the trees, usually following petal fall, and mate. The females produce live crawlers about 4–6 weeks after mating; these make their way to new sites and insert their mouthparts into the tree, secreting a white waxy covering that eventually darkens to black. SJS infestations on the bark contribute to an overall decline in tree vigor, growth, and productivity. Fruit feeding causes distinct red-purple spots that decrease the cosmetic appeal of the fruit. Insecticidal sprays are most effective when directed against the first generation crawlers, specifically timed for the first and peak crawler activity, which are usually 7–10 days apart.

In the Geneva area, first crawler emergence has tended to occur sometime around mid-June. If and when a treatment against this stage is needed, Esteem 35WP is one option. It should be applied at 4-5 oz/acre at first crawler emergence; a low rate (0.25% or 1 qt/100) of a highly refined summer oil (see above) has been shown to improve penetration and, therefore, control. Additional products showing control efficacy include Centaur (except Nassau and Suffolk Counties), Movento (which must be mixed with an organosilicone or nonionic spray adjuvant), Sivanto Prime, Venerate, and Assail. Other options include Imidan, Admire, or pre-mixes such as Endigo, Leverage, or Besiege. These applications should also be effective against White Prunicola Scale, which has gotten to be increasingly common of in our area, in apples as well as peaches.



San Jose Scale female scale covering and winged male adult. Photo credit 2013 Encyclopedia Britannica Inc.

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Codling Moth

Codling moth larvae. Photo: Utah State University Extension

Your best control will come from timing your sprays based on degree day accumulations following your biofix date. Again, these timings can be determined using your trap data and the Insect Pest Models page on NEWA. The first spray is recommended at 150 DD (base 50ºF) for ovicidal materials (Rimon, Intrepid, Esteem), at 250-360 DD for larvicidal materials. Options include the diamides, Assail, Delegate, and possibly Imidan, depending on the status of resistance in your local populations. Options for mating disruption, always a recommended complement to your insecticide programs, include Isomate CM/OFM TT or CM/OFM Mist; Suterra Puffer CMOFM, and Cidetrak CMDA Combo Meso-A. As for oriental fruit moth, don't overlook the potential contribution of granulosis virus products (Madex and Virosoft CP4) as a complement to your management program.

Woolly Apple Aphid

There have been a few reports of blocks with problematic populations of woolies last year. Options include Diazinon (the best, but a problematic choice for some growers); Movento at PF–1C or whenever infestations are noted, and also Assail and Sivanto.

Wooly apple aphid. Photo: Greg Krawczyk

Black Stem Borer

Management options are still considered provisional, since nothing we have will completely control this insect. However, trunk sprays are definitely the best option; 2 are recommended, using Lorsban for one, and Warrior or Danitol for the other. Timing would be now for the first application, followed by another in 2 weeks. [Only one of the 15 Lorsban products labeled for trunk applications can be used, and it may only be used up until July 31stth of this year]

Dogwood Borer

From our observations, DWB is very widespread throughout many Eastern NY orchards with young plantings. While we do not have a complete picture of the effects of these borers on dwarf trees, we do know that they reduce vigor and can, in time, completely girdle and kill trees.

In New York, adult emergence generally begins about early June, with flight peaking in about mid-July.

Our tests have shown that dogwood borers can be controlled season -long by applying Lorsban at one of a variety of times in the spring and summer. A postbloom application (to the trunk only) of a Lorsban product labeled for apple trunk applications is still allowed up through July 31st of this year. Recall that Lorsban label restrictions allow only ONE application of any chlorpyrifos product in apples, whether as a foliar or trunk spray, so these recommendations pertain only if no earlier applications have been made during the season. If you cannot use Lorsban, another option would be two coarse trunk applications of Assail; one by mid-June, and another by early August. Additionally we have a mating disruption option available, Isomate-DWB, which we have found to be very effective in interfering with these insects' pheromone communication process. Use of this product would be recommended as a tactic up to early June, before the first adult catch of the season, and in plantings with annual DWB pressure, should be considered as a valuable complement to a trunk spray program.

Gypsy Moth

Gypsy moth larvae. Photo: Dan Prairie

2nd–3rd-instar larvae have been reported in some apple plantings in ENY. These are readily controlled by some of the broad-spectrum insecticides, including Imidan, Delegate, Danitol, and the B.t.s (Agree, Dipel, Deliver, Javelin, etc.).

Brown Marmorated Stink Bug

It's too early to think about control just yet, but if any are found inside your orchard later in the summer, a treatment should be considered. We may get a Section 18 label for bifenthrin [Brigade/Bifenture] in NY again this year; alternative options include Endigo, Besiege, and Lannate.

Pear Psylla

These insects should also have been making steady progress, and the warming temperatures will eventually result in the production of summer nymphs. Since resistance issues are always a challenge, it makes sense to rotate among classes that you haven't used before. Particularly if you weren't able to get an oil spray on before bloom, populations of 1–2 per leaf would be an indication of the need for a prudent application of Agri-Mek at this time. Alternatively, Actara, Admire, Assail, Centaur, Danitol, Delegate, Esteem, Exirel, Movento,

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Nexter, Portal, Sivanto Prime, Warrior, Voliam Flexi and Agri-Flex also have varying degrees of effectiveness against this pest, usually negatively correlated with frequency of past use. Additionally, the recently expanded Magister label includes pear psylla, which we haven't tested, but may show promise owing to its being a novel a.i. (fenazaquin) against this species.

Spotted Wing Drosophila

Spotted wing drosophila. Photo: Oregon Department of Agriculture

Normally not considered to be a significant threat to tree fruits, SWD has caused problems in sweet and (particularly) tart cherry plantings over the past few years. Most programs require weekly applications, and the options comprise several pyrethroids (Mustang Maxx, Danitol, Lambda-Cy), as well as Delegate, Entrust, Exirel, and Grandevo. The SWD blog site (http://blogs.cornell.edu/swd1/) contains current trapping results and links to quick guides for product selection in various tree fruits and berry crops.

Stone Fruit Aphids

Although green peach aphid is not always a serious pest every year, colonies of these greenish, smooth-looking aphids are likely to occur in peach blocks during this period, along with their damage, which causes curled leaves that may turn yellow or red in severe cases. The young aphids begin to hatch about the time of peach bloom and remain on the trees for 2–3 generations, until early summer, when they seek other hosts (mainly vegetable truck crops). Green peach aphids suck the sap from the new fruits and twigs, and are also found on plum, apricot, cherry, and many ornamental shrubs. These insects are difficult to control; the recommended options, where needed, include Actara, Admire, Assail, Beleaf, Grandevo and Movento. Lannate is an alternative, but possibly less effective choice. Applications are recommended before excessive leaf curling occurs, in order to maximize the spray's effectiveness. Also, keep an eye out for black cherry aphid in your cherry trees after shuck fall. If colonies are building up on the foliage, recommended materials include Admire, Assail, Beleaf, Exirel, Grandevo, Movento, Sevin, and pyrethroids such as Baythroid, and Warrior. Pre-mixes labeled for this use include Endigo, Leverage, Minecto Pro, Voliam Flexi and Voliam Xpress/ Besiege.

Cherry Fruit Flies

It is too early for catches of adults on sticky board traps, but because of the zero tolerance in cherries for insect damage or presence, it is prudent to begin sprays in your cherries soon after shuck split (for this pest as well as for curculio). Imidan (tart cherries only), Sevin, Diazinon, Assail, Actara, Delegate or the pyrethroids are all effective treatments. Sevin will also control black cherry aphid.

Lesser Peachtree Borer

Remember to get your trunk and scaffold sprays on peaches and cherries during the next couple of weeks if borers are a problem in your blocks and you are electing this approach. A better and preferred alternative is Isomate-PTB Dual for pheromone disruption. Now is a good time to think about hanging the ties (150-250/acre will disrupt both species — Peachtree Borer appears about mid-June in our region; use the higher rate where pressure is more severe). This pest increases the severity of Cytospora canker infections in peaches and is often found within the canker; by feeding in the callus tissues, it interferes with the tree's natural defenses against the disease. Infestations can be determined by the presence of the insect's frass, which resembles sawdust, in the gum exuded from the wound. In peaches, you can use Baythroid, Lorsban (only the formulations with apple trunk sprays permitted on the label, and only up through July 31), Pounce, or Warrior for this application (or pre-mixes such as Endigo, Gladiator, Leverage, or Besiege). In cherries, use Baythroid, [Lorsban (tarts only), as a trunk spray ONLY with one of the 15 products with apple trunk sprays on the label; use by July 31 and do not spray the fruit], Pounce, Warrior, Endigo, Gladiator, or Besiege, and observe the proper PHIs for these respective materials. Check the labels of all products for the recommended target area, where applicable (trunk vs. foliar).

'Honeycrisp' Bitter Pit Response to Rootstock and Region under Eastern NY Climate Conditions

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The following is a summary of the full article published May 2021 in the MDPI open-access journal "Plants". The full text document along with all figures and tables can be accessed by clicking on the link here or typing the following URL into your web browser: https:// www.mdpi.com/2223-7747/10/5/983/htm#

Study Objective

The aim of this study was to broadly examine potential contributors to the large variation observed in the rate of bitter pit incidence on 'Honeycrisp' in the New York State climatic environment. We focused on rootstock and region, analyzing weather, soil, horticultural and fruit quality variables, using multivariate and binomial distribution analysis techniques.

In the course of this work, we evaluated a high number of parameters as possible indicators of BP incidence, including weather and soil traits, horticultural and fruit quality characteristics, through the perspective of region and rootstock choice, by conducting a detailed survey of 34 'Honeycrisp' blocks distributed across two growing regions in Eastern NY, which at the end we included 30 blocks in our analysis. Our goal was to describe as much of the

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biological and abiotic world that our 6-tree experimental units were expected to thrive in while producing marketable fruit in commercial settings. This article will focus on four findings we believe to be the most immediately valuable to commercial 'Honeycrisp' producers. A much more complete and detailed analysis and discussion can be found in the full-length *Plants* paper. The authors can say with confidence that the commercial producers who donated their orchards to this study were among the most skilled in New York State, with well-managed 'Honeycrisp' plantings.

Materials and Methods

There remain unknown factors at play in the causation of bitter pit in 'Honeycrisp' as well as in other apple varieties. To investigate some of these factors, we conducted a survey of 34 mature tall spindle and vertical axis 'Honeycrisp' orchard blocks (Table 1) distributed across two disparate production regions in eastern New York State, representing a variety of rootstocks, over three growing seasons. Each experimental unit consisted of six contiguous trees selected for their uniformity. Weather, soil, horticultural traits, fruit quality traits, three pick timings, leaf and peel minerals, at total of 43 parameters were evaluated for their impact on bitter pit (BP) incidence; factors were further evaluated for their interaction with region and rootstock. A total of 13,770 apples were individually rated and tracked through storage for selected fruit quality parameters whenever practical. Continuous, binomial, parametric and non-parametric statistical analyses were applied as appropriate.

Table 1. Site descriptions.

Region	Orchard	Farm	Elevation (m)	Rootstock	Rootstock Category	Soil Texture	Soil Water Capacity	Soil Aggregate Stability
Hudson Valley (HV)	1	Porpiglia	136	M.9-337	M.9 Clone	Silt loam	0.298	23.1
	2	Porpiglia	127	M.9-337	M.9 Clone	Sandy loam	0.186	19.2
	3	MG Hurd	176	M.9-337	M.9 Clone	Loam	0.225	13.5
	4	WG Minard	133	M.9-337	M.9 Clone	Silt loam	0.243	47.9
	5	WG Minard	127	M.9-337	M.9 Clone	Silt loam	0.236	48.5
	6	Crist Bros	151	M.26	M.26	Loam	0.178	5.2
	7	Crist Bros	149	B.9	B.9	Loam	0.278	11.0
	8	Crist Bros	158	M.26	M.26	Loam	0.214	29.1
	9	Mead	65	B.9	B.9	Loam	0.180	69.0
	10	Yonder	82	B.9	B.9	Silt loam	0.197	43.4
	11	Bartolotta	75	M.26	M.26	Silt loam	0.195	39.8
	12	Bartolotta	91	M.9-337	M.9 Clone	Loam	0.181	25.8
	13	Fix Bros	77	B.9	B.9	Silt loam	0.205	32.2
	14	Fix Bros	58	Pajam2	M.9 Clone	Sandy loam	0.156	23.5
	15	Yonder	91	M.26	M.26	Sandy loam	0.105	17.9
	16	Yonder	88	NIC29	M.9 Clone	Sandy loam	0.127	12.6
	17	Yonder	93	M.9-337	M.9 Clone	Loam	0.187	15.5
	18	Yonder	98	M.26	M.26	Silt loam	0.194	22.6
	19	Saulpaugh	78	M.26	M.26	Sandy loam	0.127	30.7
	20	Saulpaugh	72	MM.106	Other	Sandy loam	0.120	45.9
Champlain Valley (CV)	21	Chazy	49	M.9-337	M.9 Clone	Silt loam	0.168	46.2
	22	Chazy	38	B.118	Other	Silt loam	0.194	44.9
	23	Chazy	33	B.9	B.9	Loamy sand	0.085	52.9
	24	Chazy	60	B.9	B.9	Silt loam	0.209	28.8
	25	Forrence	121	M.26	M.26	Loam	0.177	10.7
	26	Forrence	119	M.26	M.26	Sandy loam	0.113	19.9
	27	Forrence	48	M.26	M.26	Loam	0.132	46.8
	28	Forrence	56	M.26	M.26	Sandy loam	0.126	48.5
	29	Northern	134	B.9	B.9	Loam	0.143	28.3
	30	Northern	128	M.26	M.26	Loam	0.156	37.2
	31	Northern	185	G.30	Other	Loam	0.138	18.3
	32	Hart	127	EM.7	Other	Loam	0.174	36.3
	33	Hart	127	B.9	B.9	Loam	0.134	17.7
	34	Hart	127	B.9	B.9	Loam	0.154	31.2

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Results and Discussion

Commonly Considered Horticultural Parameters

'Honeycrisp' trees on B.9 rootstock were smaller but with comparable terminal shoot growth when compared to those on M.26 and M.9 rootstocks. B.9 fruits, which had similar fruit size to M.26 and M.9 and had good fruit quality at harvest and after storage, were much less likely to express bitter pit symptoms compared to M.9 and M.26 rootstocks.

Regional and Rootstock Effects on Bitter Pit

Regional and local environmental and soil conditions must be taken in consideration when planting a new orchard and may be significant contributors to BP predisposition. To the best of our knowledge, this is the first study evaluating the region effect on the occurrence of BP. After three years and comparing the two regions, we found that, in general, 'Honeycrisp' orchards from the HV region presented high BP incidence relative to the Champlain Valley. This region received more rain and experienced higher temperatures over the study period, which may explain partially the difference in BP.

Rootstock choice is one of the most critical elements of any apple orchard to provide sufficient growth control, enhanced precocity, higher yield, improved adaptability to environmental conditions, and better fruit quality [1]. In addition to effects on these traits, apple rootstocks have a diverse influence on the nutritional status of the tree canopy, are implicated in the physiology of BP and, therefore, can affect the occurrence of BP [2,3,4], as it is demonstrated in our results. However, the BP response to tissue mineral status is variable depending on the rootstock and the region where it is planted. As a result, the occurrence of BP can be more or less intense or absent even as local tree tissue mineral measurements suggest otherwise.

We evaluated three of the most popular rootstocks used in high-density apple orchards in New York State: B.9, M.26 and M.9 clones [1]. Among them, fruits from 'Honeycrisp' grafted on M.26 were slightly more susceptible to BP than those from M.9 clones and much more susceptible than B.9. In agreement with Lordan et al. [4]

B.9 rootstocks had a much lower incidence of BP compared to M.26 and M.9 clones, even in the very dry year of 2016. In general, B.9 BP incidence values did not differ significantly among years by region, even when both regions were evaluated together. Kim and Ko [5] reported that BP is more intensive on moderate, vigorous rootstocks compared to less vigorous rootstocks, which is consistent with our results, as M.26 is the most vigorous rootstock in terms of TCSA evaluated in this study.

Shoot Growth Effects on Bitter Pit

Terminal shoot extension (ALTS) was a poor indicator of vigor and BP incidence as ALTS was very similar between the three rootstocks while BP differed significantly.

Nutrient Status Effects on Bitter Pit

In terms of nutrient status, region and rootstock had a significant effect on some of these traits, results that were somewhat expected. Other authors have also reported that region and rootstock can affect similar horticultural traits under Hudson Valley and Champlain Valley climatic conditions for 'Gala', 'Fuji' and 'Honeycrisp' [6,1,4]. In this study, the most vigorous rootstock, M.26, had higher leaf K/Ca, Mg/Ca and B/Ca ratios, leaf K, and peel B, but lower leaf Ca, Mn, and P values as compared to B.9 and M.9 clones.

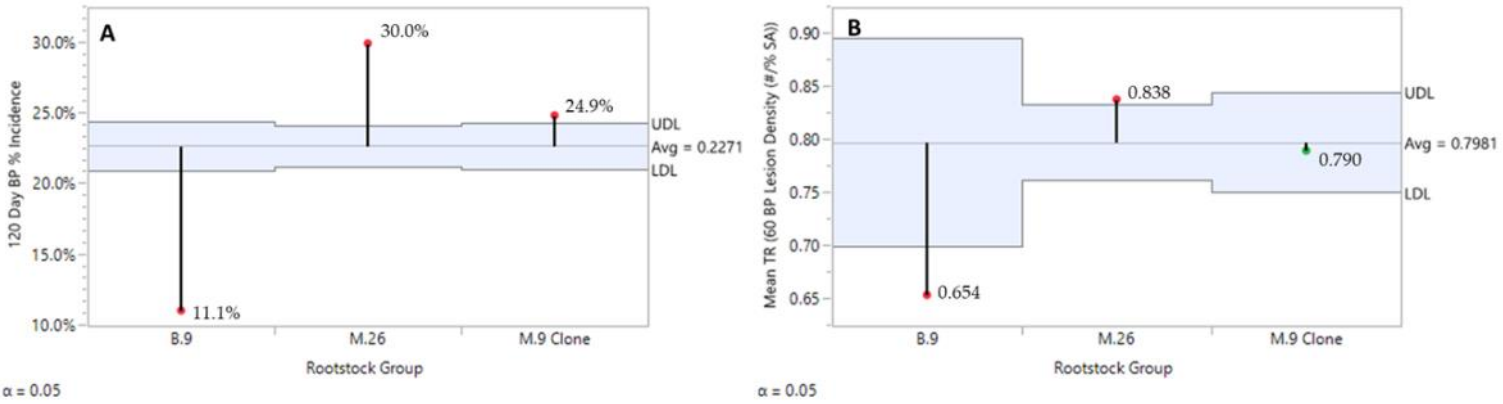

Figure 1. Rootstock effect on 'Honeycrisp' bitter pit incidence (A) and on 'Honeycrisp' bitter pit severity (B) after 120 days of refrigerated storage with all years and both regions combined (A). JMP Fit XY Platform, Analysis of Means of Proportions of the binomial dataset, alpha = 0.05. The B.9 rootstock demonstrated superior BP performance in incidence (does the apple have BP? Yes or No) and in severity as well (if the apple has BP, just how dense are the lesion counts?).

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Between regions, 'Honeycrisp' orchards, despite showing significant differences, some of these nutritional traits were not correlated to BP incidence after a period of refrigerated storage. 'Honeycrisp' fruits from CV orchards tended to have less BP incidence after storage (less than 10%) compared to those from HV. This lower BP value may explain the lower number of correlations with the horticultural traits, as well as the higher BP incidence values of M.26 orchards from HV could explain the higher number of significant correlations with horticultural traits compared to those from CV region.

Little correlation was found between BP incidence after storage on 'Honeycrisp' fruits from B.9 in terms of nutrient status, TCSA, peel Mg/Ca and peel Ca, whereas more significant correlations were found in fruit from the M.26 and M.9 clones, mainly the peel minerals. The lower BP incidence values from B.9 fruits could explain the lack of correlations compared to M.26 and M.9 clone rootstocks. These two rootstocks had some correlations in common, such as peel K/Ca, peel Mg/Ca, peel B/Ca, peel B, peel Ca, peel K and peel P, but M.9 clone rootstocks had higher values.

Recent studies have shown that BP, a Ca2+-related deficiency disorder, is not necessarily related to low Ca2+ concentration in fruit tissue in a "global" sense. In fact, chemical and X-ray analysis have shown that apple fruit tissue with visual Ca2+ deficiency symptoms had higher Ca2+ concentration than healthy fruit tissue [7]. Most Ca2+ in fruit tissue, between 60 and 75%, is bound to the cell wall. More Ca2+ binding to the cell wall is consistent with the finding that BP-damaged tissues have more Ca2+ than the surrounding healthy tissues [8,9]. In agreement with this statement and previous studies [3,10], we found a high and negative correlation between peel Ca2+ concentration and BP incidence after storage for all three rootstock categories and two regions.

Fruit Quality Trait Effects on Bitter Pit

Fruit quality traits were also affected by region and rootstock, in agreement with previous rootstocks studies performed in 'Gala', 'Fuji', 'Honeycrisp' and 'Red Delicious' under Hudson Valley and Champlain Valley climatic conditions [6,1,4,11]. Both regions (CV and HV) had similar correlations between fruit dimensions and BP incidence after storage, despite showing significant differences on these traits. However, blush only correlated with BP on those 'Honeycrisp' from CV. BP incidence after storage had few and inconsistent correlations with fruit dimensions and fruit quality traits when rootstocks were compared. 'Honeycrisp' fruits from M.26 rootstock, which had in general smaller FD because they were more elongated but similar FW to B.9 and M.9 clones, presented a moderate positive correlation with BP incidence after storage on these three parameters, and a medium negative correlation with blush. In contrast, B.9 did not present any correlation on the same traits, while M.9 clones did in FD and FW, perhaps this finding is associated with lower levels of BP and less variability in the B.9 orchards. A similar trend was observed regionally for B.9.

Effect of Pick Timing on Bitter Pit Incidence

'Honeycrisp' fruits were harvested at optimum commercial harvest quality at each of the three weekly picking times. Minor fruit quality and maturity differences between picks at harvest were found but considered to be commercially acceptable for storage and marketing purposes. BP incidence at the time of harvest was relatively low and varied only slightly by pick with the pick 3 (last pick) apples expressing slightly more BP (Figure 2A). It would be unlikely for a commercial producer to observe the slight uptick in BP in the field. In contrast, BP incidence after storage showed a significant decreasing trend in each of the later picks in the HV, while in the lower BP environment of the CV, picks 2 and 3 were found to be similar, and lower than pick 1 (Figure 2B).

'Honeycrisp' fruits picked earlier were firmer, smaller, with more red blush and presented higher BP in storage. Therefore, in agreement with Prange et al. [12], BP is more severe in early-picked than in later -picked apples. However, there may be an optimum stage of fruit maturity (or harvest date) for 'Honeycrisp' when fruit are of sufficient size and color to meet market requirements while minimizing the risk of manifesting BP, especially if the fruit are >250 g in size. Our study did not attempt to specifically evaluate that possibility. We closely adhered to commonly accepted commercial quality standards. In any case there may not be much room available

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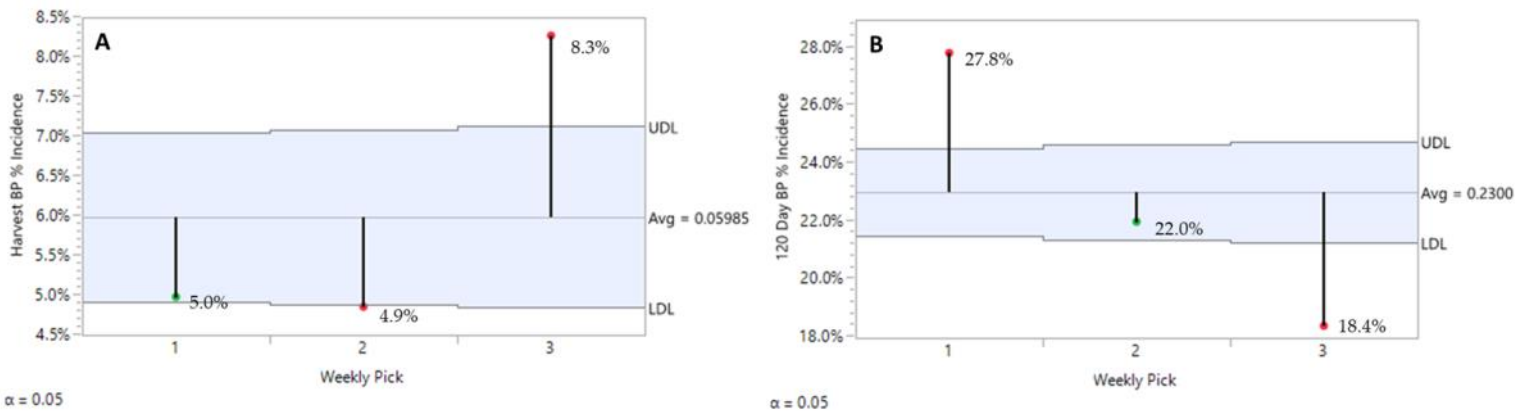

Figure 2. Pick timing effect on 'Honeycrisp' bitter pit incidence at harvest (A) and after 120 days of refrigerated storage (B) with all rootstocks and years combined. JMP Fit XY Platform, Analysis of Means of Proportions of the binomial dataset, alpha = 0.05.

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to adjust harvest dates and maintain a balance of quality factors acceptable to the marketplace.

Fruit Size and Bitter Pit Incidence

Increasing fruit size has been associated with increased BP incidence [13]. The relationship was further defined by Reid and Kalcsits [14] in a water relations study where fruit size was categorized into four classes based on diameter, with BP incidence effectively doubling between the 80–90 mm and over 90 mm categories. Our study takes this approach a step further, with the use of ten commercial weight categories in the range of 48 count (largest) down to 140 count (smallest) based on common marketing practice (Figure 3). For all storage fruit in this study the frequency distribution of across the ten categories approximated the bell shape of a normal distribution with the top of the "bell" flattened (data not shown), with 92% of the fruit falling into count categories 56 to 113. For all three rootstocks, fruit in the categories 48 and 56 were the most susceptible to BP. While our categories were based on weight ranges, our fruit diameter data shows that 48 count apples averaged 94.1 mm and 56 count apples averaged 89.3 mm, both categories roughly equivalent to the largest size category described in the Reid and Kalcsits [14] study which also experienced an elevated incidence of BP. The relationships start to change by rootstock as we move into the more commonly marketed size categories. Fruit produced on B.9 had a relatively neutral relationship of BP to size in the range from 64 to 140 as the BP incidence curve flattened and oscillated around a mean of 11.2% incidence (Figure 3B). Fruit produced on M.9 demonstrated a decline in BP incidence with decreasing size, with incidence falling from 29.2% (64 count) to 13.3% (113 count) (Figure 3D). Fruit produced on M.26 demonstrated the most severe relationship falling from 40.6% to 14.6% over the same count size range (Figure 3C). There are orchard management implications associated with these findings. As much as the industry recognizes that larger fruit have more bitter pit, as a practical matter the first priority of a properly managed crop load reduction program is to produce fruit in marketable sizes, and then facilitate adequate return bloom to avoid biennial bearing. Minimizing the production of 48 and 56 count apples will have a positive effect on orchard financial returns for all rootstocks represented in this study. Beyond that, a shift in frequency distribution to smaller fruit is not likely to help in a B.9 orchard and will only slightly reduce the average BP incidence in M.9 clone and M.26 orchards.

The Complexity of Bitter Pit Prediction Modeling

While BP incidence has been related to individual mineral element concentrations and ratios of mineral pairs in many apple studies, one should not underestimate the complex environment that the roots (soil type, soil pH, water availability, soil moisture, etc.), and the scion (rainfall, light intensity, crop load, heat unit accumulation) operate in, in conjunction with the final fruit traits influence by producer management practices during the course of the dormant and growing seasons. For this reason, we pooled together all the traits evaluated in this study, except for CL, which was not evaluated in 2018, to identify the PLS prediction model on BP for each region and each rootstock based on the NIPALS algorithm.

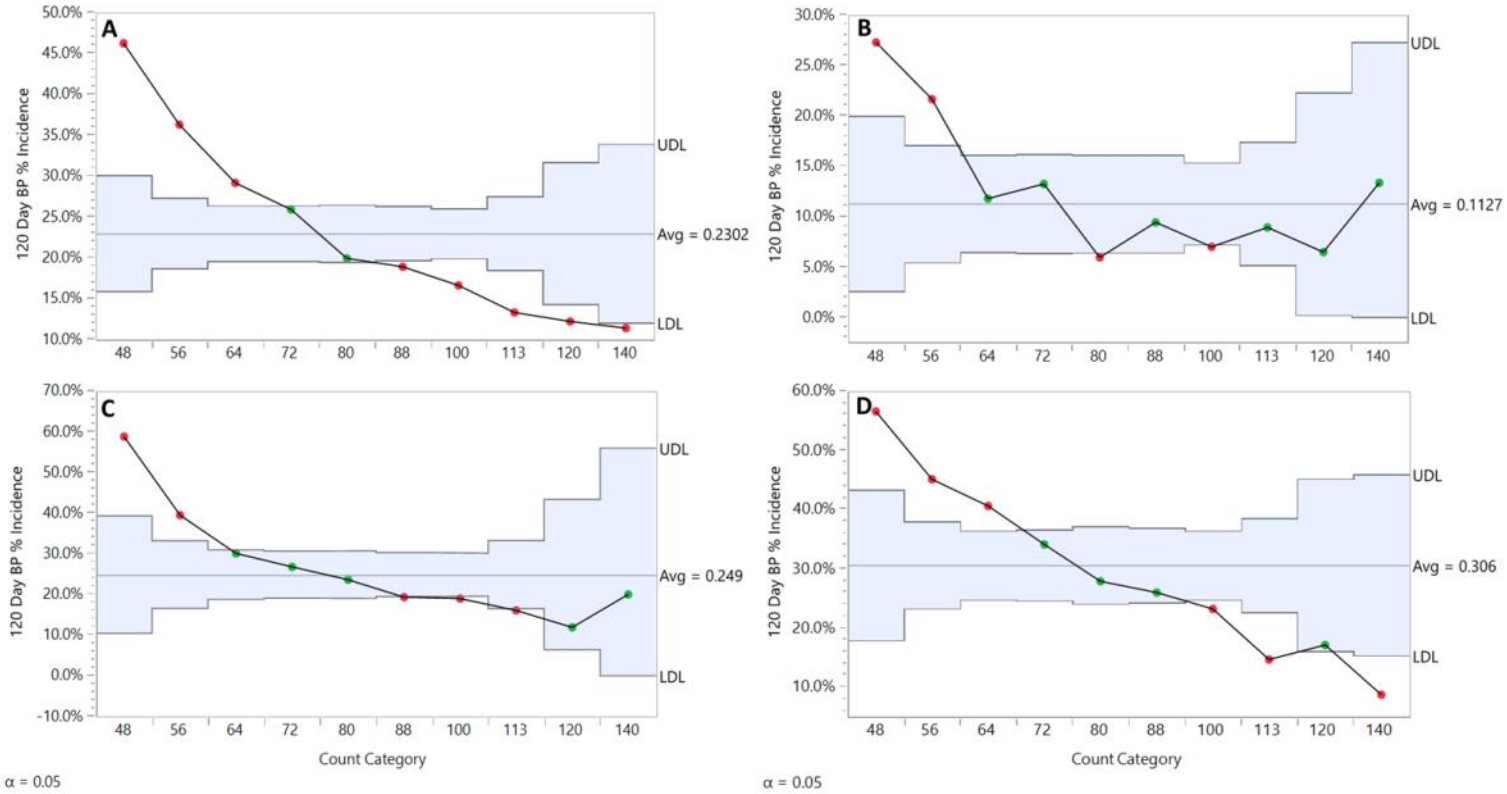

Figure 3. 'Honeycrisp' bitter pit incidence after 120 days storage by count size category, all rootstocks, regions, and years (A), and by B.9 (B), M.26 (C) and M.9 clone (D) all regions and all years. JMP Fit XY Platform, Analysis of Means of Proportions of the binomial dataset, alpha = 0.05.

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Based on the results, the PLS prediction model for each region (CV and HV) and each rootstock (B.9, M.26 and M.9 clone) showed a different threshold of variables correlated to BP, described above for each PLS prediction model (Figure 4). However, comparing all PLS analysis, only seven VIP variables were in common, peel K/Ca, peel Mg/Ca, and peel B/Ca ratios, peel Ca, FD, L/FD, and FW, showing the great variability found in this study. It is also interesting to point out that none of the environmental variables and soil variables evaluated in this study were VIP variables in common among rootstocks or between regions. The 34 orchards evaluated in this study over three years represent a wide range of these variables, therefore, these results could help to emphasize their influence on BP incidence when taking in consideration each rootstock and each region as a single unit to evaluate.

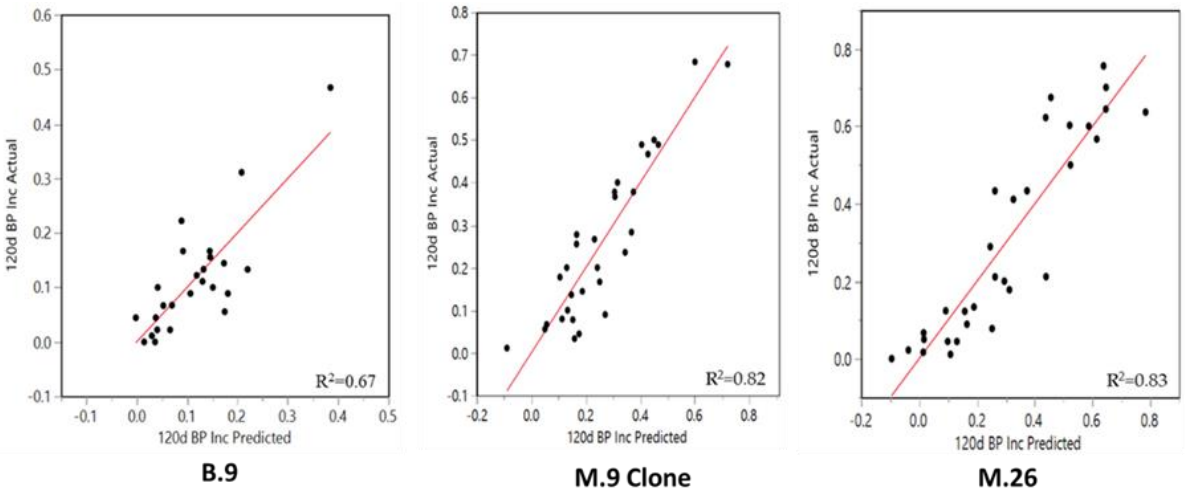

Figure 4. Results obtained from the partial least square (PLS) analysis between BP incidence at 120 DAH and the rest of variables evaluated all three years together, B.9, M.9 Clone, and M.26 rootstocks in HV and CV. Significant observed values versus PLSR-predicted values for BP for each rootstock. Of the 25 variables considered significant for B.9, 30 for M.9, and 31 for M.26, only seven variables with VIP graph values over 0.8 were found to be in common for all three rootstocks. Please refer back to the original paper for the related VIP graphics and descriptions.

Summary and Conclusions

The results of this work have the potential for a dramatic impact on commercial management and mitigation of BP in 'Honeycrisp' production. In order to facilitate real-time management changes, producers and marketers need practical tools and proven horticultural practices that mitigate bitter pit incidence and reduce storage decision risk. Bitter pit prediction models are currently in various stages of development, validation, and commercial implementation [15,16,17] with all three taking different approaches to meet the same goal of reliable pre-harvest prediction of 'Honeycrisp' fruit BP performance in storage. Recommended approaches should be on those that are simple to implement at a low cost to the producer. However, the large number of variables suggests that simple and commercially achievable models consisting of 1–3 variables will always be lacking in absolute accuracy. Fortunately for practical implementation within the apple industry, accuracy thresholds for commercial implementation are more tolerant of error than those considered acceptable in academic settings. The goal is to provide effective storage management guidance which ultimately protects the producer from making the unprofitable decision to store fruit from an orchard that turns out to suffer substantial losses to BP months later.

Not all traits evaluated individually correlated significatively with bitter pit incidence after a period in storage. Depending on rootstock and region, the correlation could be significant in one situation, with no correlation at all in another. In this study, peel Mg/Ca ratio and peel Ca correlated with BP for all three rootstocks, with the strongest correlations associated with the M.9 clones. These same traits correlated with BP for both regions. Pick timing had a significant influence on BP incidence following storage, with later picks offering better bitter pit storage performance. While excessively large fruits, those in the 48 and 56 count size categories, were found to be highly susceptible to BP regardless of rootstock, B.9 BP fruit susceptibility for lesser sizes was found to be size neutral. A PLSR prediction model for each rootstock and each region showed that different variables correlated to BP depending on the situation.

We suggest that the BP performance of a rootstock should be a major consideration when choosing a rootstock for a new 'Honeycrisp' orchard in New York State and likely elsewhere as well. Unfortunately, data beyond anecdotal observations is difficult to find, and considering the variability found in this study, likely to be highly unreliable. We suggest that rootstocks newly introduced to the commercial market should be tested for BP performance during the developmental phase and before being recommended for widespread use with 'Honeycrisp", beyond the scope of modest producer test plantings.

In a more basic sense, these results could also suggest that in addition to the variables considered in this study, and commonly studied in others, there are other, less studied factors or triggers (genetic, histological, hormonal, abiotic stress situations, etc.) that can influence the physical expression of BP symptoms. With that said, identifying and understanding these factors may help to uncover the mechanism within the tree associated with the fruit, maintaining an adequate supply of calcium cations in the vicinity of groups of cells, making sure that they are available at the appropriate time, and what factors or combinations of factors influence the effectiveness of this calcium delivery mechanism, if possible.

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Acknowledgments

The authors wish to acknowledge the efforts and in-kind contributions of all who collaborated with us towards the successful implementation of this project. Thank you to the Cornell Nutrition Analysis Laboratory, the Cornell Hudson Valley Research Laboratory, The Cornell Cooperative Extension Eastern New York Commercial Horticulture Program, and the 13 Eastern New York State apple producers (Table 1) for their contribution of laboratory and cold storage space, orchard sites, and substantial donations of experimental fruit. A special thank you to the many people who have helped our team by providing valuable guidance and insight including but not limited to Michael Rutzke, Christopher Watkins, Lailiang Cheng, Yousef Al Shoffe, Srdan Acimovic, Andy Galimberti, Sarah Tobin, Dana Acimovic, and Jeff Alicandro. Funding was provided by the New York State Department of Agriculture and Markets Apple Research and Development Program.

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New Recommendation for Return Bloom Sprays Applied in 2021 for Good Repeat Bloom in 2022

Terence Robinson, Cornell University

For many years we have recommended four summer sprays spaced 10 days apart beginning on June 21 (longest day of the year) of either 10ppm NAA or 1pt of Ethrel. This timing is usually when fruits are 25mm in diameter. This program has worked well for many biennial varieties like Fuji, Golden Delicious, Macoun, Jonagold and Delicious. However, with Honeycrisp this four-spray program has been inconsistent in inducing return bloom. Some years there is a significant improvement in return bloom from these summer sprays but in other years there is no improvement in return bloom.

The reasons for this inconsistency have been unclear but our recent work points to two important reasons why the summer return bloom sprays do not consistently work for Honeycrisp.

1. Work done by Poliana Francescatto in my lab while I was on leave showed that flower initiation for Honeycrisp occurs much earlier in the season than for other varieties. The peak period of flower initiation is 45-55 days after full bloom. For WNY with an average bloom date of May 5, the peak period of flower initiation is mid-June to late June. Thus, starting the summer sprays of Ethrel or NAA at an earlier date would better overlap with the date of flower initiation. It appears that the traditional

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timing of summer sprays is too late.

2. In some years the number of flower clusters and initial fruit number is very high. If the seed number per fruit is also high resulting in a large number of seeds on the tree, then return flowering is strongly inhibited by the gibberellins produced in the seeds. Under this scenario the flower initiation stimulating properties of Ethrel or NAA are counter balanced and completely negated by the excessive GA level in the plant. In other years with fewer initial flower clusters or with lower seed count per fruit then the total GA load in the plant from a more moderate number of seeds per tree allows the NAA or Ethrel sprays to stimulate flower initiation.

These clues have led us to emphasize 1) precision pruning for Honeycrisp to reduce the initial flower bud load to no more than 1.8 times the target fruit number. This avoids having an excessive number of seeds producing too much GA to inhibit flowering. 2) We have also emphasized bloom thinning and Petal Fall thinning to reduce the fruit number to the target number very early in the season to ensure that at 45 days after full bloom when flower initiation occurs, there are not too many fruits, seeds and GA in the tree.

We now introduce a new recommendation to begin the series of summer return bloom sprays of Ethrel or NAA on Honeycrisp earlier in the season beginning at the 16mm fruit size stage. For strongly biennial varieties (Honeycrisp and Fuji) we suggest 4 sprays at 10-day intervals of Ethrel beginning when fruits are 16mm. The first 2 sprays should be at a low rate of ½ pint/100 and last 2 sprays at a higher rate of 1 pt/100). In addition, once the 4 sprays of Ethrel are completed, we recommend to apply 2 more sprays of 10ppm NAA at 10-day intervals.

This new recommendation comes with strong caution. Ethrel is a powerful thinner from full bloom until fruits are 18mm. Its effects are very powerful when temperatures are above 80°F. Thus, there is some risk of thinning action when the first Ethrel spray for return bloom is applied at 16mm fruit size. To minimize the risk of thinning at this time we recommend that it only be applied when temperatures are below 80°F.

This new recommendation of early Ethrel sprays is most important during the "on" year and will help ensure repeat bloom in the following year. Its success depends on not having an excess number of seeds on the tree since the high GA load from excessive number of seeds will overwhelm the flower inducing properties of Ethrel. Thus, strict attention to precision pruning and precision thinning to achieve the target fruit load early in the season will be key to success.

Farmers Market Promotion Program Applications are Due June 21!

Elizabeth Higgins, Ag Business Management Specialist

The USDA Farmers Market Promotion Program Grant can do much more than fund farmers markets. Agritourism initiatives, CSAs, roadside stands, and online sales are all eligible. The key is direct to consumer sales. If you have any questions, contact Elizabeth Higgins emh56@cornell.edu.

I will hold an evening webinar on Monday June 7th at 6:30 to go over the program and answer questions you may have on it. I have reviewed proposals for this program in the past and can help you determine if your project could be competitive. To register, go to: https://cornell.zoom.us/webinar/register/WN_WttL5lDhRgOrX09f2km6cQ

The Farmers Market Promotion Program (FMPP) funds projects that develop, coordinate and expand direct producer-to-consumer markets to help increase access to and availability of locally and regionally produced agricultural products by developing, coordinating, expanding, and providing outreach, training, and technical assistance to domestic farmers markets, roadside stands, community-supported agriculture programs, agritourism activities, online sales or other direct producer-to-consumer (including direct producer-to-retail, direct producer-to-restaurant and direct producer-to-institutional marketing) market opportunities.

Entities that are eligible to apply include:

- Agricultural businesses and cooperatives
- Community Supported Agriculture (CSA) networks and associations
- Food Councils
- Economic development corporations
- Local governments
- Nonprofit and public benefit corporations
- Producer networks or associations
- Regional farmers' market authorities
- Tribal Governments

Additional Information

The deadline for submitting applications for the 2021 Request for Applications is June 21, 2021 at 11:59 p.m. Eastern time. See https://www.ams.usda.gov/services/grants/fmpp (usda.gov) for more information.

Evaluation of Venue, Gramoxone, Aim, and Rely Herbicides for Root and Crown Sucker Control in Apple and Cherry

Timothy J. Smith and Esteban Gutierrez, Washington State University

Root and crown suckers are unwanted natural vegetative growth commonly produced by many rootstocks of deciduous fruit trees. These are especially common on Mazzard, the most common sweet cherry rootstock. However, there are strains of the apple rootstock Malling 9, such as the "Nic 29," and Budagovsky 9 that have this problem, and some pear rootstocks such as Pyrodwarf and individual "Bartlett seedling" produce significant problematic suckers. These rootstocks are planted on about 60,000 acres of Pacific Northwest orchards.

Growers often treat these suckers as they would a perennial weed, but without the option of treating them with a systemic herbicide. In fact, they are compelled to remove the suckers by mechanical or chemical methods prior to the application of glyphosate, the most common herbicide used in orchards, due to concern of excessive uptake of the herbicide into the fruit tree. The removal of the suckers by hand labor is very expensive and only possible when the sucker growth is scant. Even with light sucker growth, labor costs about $50-75 an acre, depending upon the density of the suckers. At times, the suckers are too dense to cut by hand. Labor to do this operation is becoming more expensive and difficult to find.

Sucker removal is most commonly carried out by contact herbicide application, mostly with paraquat (Gramoxone) or glufosinate-ammonium (Rely), and less often, with carfentrazone-ethyl (Aim). Venue is considered an interesting alternative to these current choices. Sucker removal is a procedure intended to injure or eliminate part of the tree attached to the green young bark at the base of a two or three year old tree. It is critically important that the product used is safe to apply to the young bark of the lower 12 inches of the trunk and the portion of the rootstock above the soil level. If the product is highly effective on suckers, it is also possible that it could damage or kill the young bark, leading to tree death. It is far less likely that a product will damage the corky bark of an older tree. To be most useful, the product must be safe in younger orchards. The paraquat labels prohibit use in orchards with "green stems." Many growers place paper or plastic wraps around the base of young trees to protect the bark from paraquat or glyphosate, but this often protects the crown suckers also, and their hand removal is made difficult by the shielding. In past trials and experience, it appears that to a great extent, it is the concentration of any specific product in solution, rather than the rate per acre that determines the risk of application to green barked trees. For example, 2.5 pints of Gramoxone in 25 gallons per acre of carrier is much more likely to damage the green bark of young trees than the same rate applied mixed with 50 gallons per acre.

Materials & Methods

Two rates of Venue SC (pyraflufen-ethyl) and Non-Ionic Surfactant (NIS 0.25% v/v) were tested for effect on root and crown suckers in apple and cherry. The Venue SC was applied at 3 fluid ounces or 4 fluid ounces per acre in about 40 gallons of water carrier with 1 quart / 100 gallons Regulaid NIS. This rate of water was sufficient to fully wet the sucker growth.

The comparison products were Aim (carfentrazoneethyl) at 2 fluid ounces per acre + Regulaid 0.25% v/v, or Rely ("Liberty," glufosinate-ammonium) 280 at 56 fluid ounces per acre + 0.25% v/v, or Gramoxone Inteon (paraquat) 2.5 pints per acre, all in about 40 gallons of water per acre. Damage to near-by tree foliage is common when Aim mist drifts, so we don't recommend its use. This is included for comparison only.

The cherry orchard used for the trial is north and west of the intersection of Edgemont and Steinbach roads in Wenatchee Heights. It is a mature orchard, Sweetheart cultivar on Mazzard roots, and has what would be considered a problem population of root suckers. There are about 1 to 10 root suckers per square foot under the trees in many areas of the block, though this is variable from replicate to replicate. There were very few crown suckers growing from the base of the trunk. All treated replicates had an average of 0.5 to 2 suckers per square foot. The tree trunks are mature, about 12 – 15 inched diameter, with corky bark. At the time of application, the

Apple trees prior to treatment.

Apple trees 10 days after Gramoxone spray.

Apple trees 14 days after Gramoxone sprays.

Apple trees 14 days after Venue sprays.

Comparison of Venue (near) and control (far).

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suckers were over optimum maximum height, ranging from 4 to 16 inches height. They were low enough that spray coverage was quite thorough, but coverage was not 100% complete in some heavy patches.

The apples are at WSU Sunrise research orchard, block 1a and 1b, cultivar Fuji or Gala, on various strains of Malling 9 and on Budagovsky 9. Suckers were very common on every 5th row, which was planted with the Nic 29 strain of M9, with suckers growing from both roots and the above-surface parts of the rootstock. The sucker growth was perhaps too advanced for optimum results; it would have been better timing about two weeks earlier. (It took time to find these plot sites.) The trunks are immature, 2 – 4 inches diameter, and with thin, lightly corked or unsuberized bark.

All materials were applied with a tractor-carried boom weed sprayer. The apple orchard was treated in a relatively narrow 3 foot wide swath width, about 18 inches out from the young trees on each side of the row. The boom had one 8002 flat fan nozzle on the outside (tractor side) and an OC 02 nozzle on the distal end of the boom to provide for overlap. The boom was about 21 inches above the soil surface, and the nozzle tips were 18 inches from the surface. Nozzles were spaced 12 inches apart on the boom. The tractor drove at 2.5 mph and at 20 psi, the 2 nozzles had a total output of 39 ounces per minute. The carrier rate per acre was calculated: (495 x 0.305 gal) / (2.5 mph x 1.5 ft.) = 40.2 gpa.

The cherry orchard was treated very similarly, but the swath was 7 feet wide, 3.5 feet out from either side of the tree row. Two 8002 flat fan nozzles were added to the tractor side of the boom, for a total of three, with one OC 02 nozzle on the end of the boom. This increased the swath width to 3.5 feet. At 22 PSI boom pressure, the total boom output increased to 81 ounces per minute, and a resulting 40.7 gallons per acre application rate. Calculation: (495 x 0.6328 gal. per min) / (2.2 mph x 3.5 ft. swath) = 40.7 gpa.

Results

The various treatments differed in degree of damage to suckers over time, and speed of damage to the suckers. The control of suckers was relatively good by 30 days after treatment with all treatments relative to the untreated check. The paraquat gave rapid, effective results within 7–10 days in both apples and cherries, The Venue was both rapid and ultimately effective in the cherries at both 3 and 4 fl oz/A, but appeared more practical at the 4 fl oz/A rate in the apples. While the Mazzard cherry root suckers were very sensitive to Venue, the Budagovsky 9 apple rootstock was moderately sensitive, and the Malling 9 was the least damaged. However, the Bud 9 and M9 suckers that recovered somewhat were almost all oversized at the time of application Those apple suckers that were less than 10 – 12 inches in length, and not "woody" at their bases were completely controlled, and had not regrown from below the surface by 60 days after application.

The Aim was also quite effective, more so on the cherries. The Rely was ultimately effective, but took 20-25 days to reach the level of control reached in 10-14 by Venue, Aim and Gramoxone. Growers are usually expecting a product to control and remove the suckers as rapidly as possible to enhance irrigation efficiently. There was no apparent trunk or crown damage in the 4th year small apple trees, despite the relatively "green" bark. There was no apparent damage to the much older cherry trunks.

In summary, all of the products were effective, especially so in the cherries. The paraquat and the Venue at 4 fl oz in 40 gpa spray rate seemed to be the most practical. These damaged only the targeted suckers. They are more rapid in effect than Rely, less of a drift hazard to fruit than Aim, but Venue is far less of a toxicity hazard to the applicator than paraquat. Venue appears to be a good choice for late spring or early summer crown and root sucker control in apples, cherries (and probably pears).

Producers with Crop Insurance to Receive Premium Benefit for Cover Crops

New Pandemic Cover Crop Program Helps Producers Continue Cover Crop Systems

WASHINGTON, June 1, 2021 – Agricultural producers who have coverage under most crop insurance policies are eligible for a premium benefit from the U.S. Department of Agriculture (USDA) if they planted cover crops during this crop year. The Pandemic Cover Crop Program (PCCP), offered by USDA's Risk Management Agency (RMA), helps farmers maintain their cover crop systems, despite the financial challenges posed by the pandemic.

The PCCP is part of USDA's Pandemic Assistance for Producers initiative, a bundle of programs to bring financial assistance to farmers, ranchers and producers who felt the impact of COVID-19 market disruptions.

"Cultivating cover crops requires a sustained, long-term investment, and the economic challenges of the pandemic made it financially challenging for many producers to maintain cover crop systems," said RMA Acting Administrator Richard Flournoy. "Producers use cover crops to improve soil health and gain other agronomic benefits, and this program will reduce producers' overall premium bill to help ensure producers can continue this climates-smart agricultural practice."

About the Premium Benefit

PCCP provides premium support to producers who insured their spring crop with most insurance policies and planted a qualifying cover crop during the 2021 crop year. The premium support is $5 per acre, but no more than the full premium owed.

All cover crops reportable to FSA are eligible and include cereals and other grasses, legumes, brassicas and other non-legume

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broadleaves, and mixtures of two or more cover crop species planted at the same time.

To receive the benefit for this program, producers must file a Report of Acreage form (FSA-578) for cover crops with USDA's Farm Service Agency (FSA) by June 15, 2021, which is distinct from the normal acreage reporting date. The normal acreage reporting deadline with FSA has not changed, but to receive the premium benefit, producers must file by June 15. The cover crop fields reported on the Report of Acreage form must match what the producer reported to their insurance company for crop insurance policies. To file the form, producers must contact and make an appointment with their local USDA Service Center.

Program Details

Certain policies are not eligible because they have underlying coverage, which would already receive the benefit or are not designed to be reported in a manner consistent with the Report of Acreage form (FSA-578).

PCCP does not change acreage reporting dates, reporting requirements, or any other terms of the crop insurance policy.

More Information

A Notice of Funding Availability was posted on the *Federal Register* today. Additional information on PCCP, including frequently asked questions, can be found at farmers.gov/pandemic-assistance/cover-crops.

Upcoming Events & Important Information

Looking for More Tree Fruit IPM Resources?

For additional Apple IPM information, we highly recommend reviewing the videos available at https://www.youtube.com/playlist?list=PLoNb8lODb49vifrm9Tla4GmAVhlIL0527.

For stone fruit IPM information, visit our video playlist on Youtube at https://www.youtube.com/playlist?list=PLk2Q-bw9Aiu5NUJa7IwI_Obs1V5-RSUGb

Honeycrisp Virtual Meetups Start This Week!

A 3-part series of conversations about Honeycrisp. Join us and bring your experience and questions! Registration for each date as follows:

June 3: Crop Load Management
https://wsu.zoom.us/webinar/register/WN_kY92ZJLFTA2e-YTuarMp2w

June 17: Rootstocks
https://wsu.zoom.us/webinar/register/WN_h5662X2oRAWhq3lcxf7WNA

July 1: Nutrient Management
https://wsu.zoom.us/webinar/register/WN_PEUvC-sZRHmkeTl7YHgA8Q

Facilitated by B. Sallato WSU Extension, M. Miranda Sazo Cornell Cooperative Extension, and A. Wallis MSU Extension. Supported by IFTA, USDA-SCRI Root2Fruit project and Good Fruit Grower. For more information visit http://treefruit.wsu.edu/event/virtual-honeycrisp-meetup/2021-06-03/

The Eastern New York Commercial Horticulture Program is a Cornell Cooperative Extension partnership between Cornell University and the CCE Associations in these seventeen counties: Albany, Clinton, Columbia, Dutchess, Essex, Fulton, Greene, Orange, Montgomery, Putnam, Rensselaer, Saratoga, Schenectady, Schoharie, Ulster, Warren & Washington.

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