scaffolds
Update on Pest Management and Crop Development
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DISEASES

FROM THE GROUND UP

APPLE TRUNK PROBLEMS CAN REDUCE PROFITABILITY

(Dave Rosenberger, Plant Pathology, Highland; dar22@cornell.edu)

❖❖ Over the past 15 years, I have become increasingly aware of the many factors that can adversely impact the growth and health of apple tree trunks. I've also vacillated between amusement and despair on various farm tours where horticulturists have expounded at length on how to prune, train, and improve fruit quality on young trees in blocks where a more "down toward earth" view would have revealed trunk problems that were almost certain to limit profitability of the block regardless of how trees were pruned or trained.

Unfortunately, trunk problems often evolve from a variety of interacting stresses, pathogens, and/or insects. The initial causes are sometimes difficult to pinpoint, and therefore solutions to these problems remain elusive. Following is a list of problems that I have observed along with my subjective perspectives on potential contributing factors and possible solutions. I'm certain that other folks will have additional and divergent opinions about causes and solutions for many of these problems, but I hope that my mentioning them will at least stimulate useful thinking and discussion.

1. Rootstock blight killing young trees: Fire blight that gets into M.9 or M.26 rootstocks in trees less than 8 or 10 years old will almost always be lethal (Fig. 1). The key to avoiding tree loss to this disease is to order all new trees on rootstocks other than the highly susceptible M.9 or M.26. If trees are propagated and planted on either of these highly

Figure 1. M.9 rootstock showing bacterial ooze from rootstock blight.

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susceptible rootstocks, then growers should expect to spend extra time and money protecting blossoms with antibiotics and/or copper sprays during at least the first eight years after trees are planted, and probably for the lifetime of the orchard. Given our changing climate and the fact that many new cultivars are very blight susceptible, one must assume that blight epidemics can occur anywhere in North America, even if some regions rarely had fire blight in the past.

2. Excessive production of root suckers in young trees: Root suckers (Fig. 2) are bad because they are difficult to manage, may prevent full coverage of trunk sprays applied to control borers, and can absorb and translocate herbicides such as glyphosate. If the rootstock is M.9 or M.26, actively growing suckers provide an entry point for fire blight that will quickly kill those rootstocks. Perhaps it is only my idealized memories of the past, but my impression is that root suckers are more prevalent in young trees and are developing in larger numbers than was the case 30 years ago. I don't know if changing nursery practices or changing cultural practices in the orchard are contributing factors. (Some folks have suggested that every time a sucker is burned down with glyphosate, all of its cousins emerge to seek revenge.) Thirty years ago, the suggested planting depth for new trees required graft unions to be two inches above the soil line after trees had settled. Because of problems with scion rooting in some orchards where graft unions ended up at or below ground level, the suggested planting height gradually changed from 2 inches to 4 inches to 6 inches, and trees that fail to settle as expected after planting may end up with 8 or 10 inches of rootstock exposed. Increasing the length of the rootstock above ground generally reduces vigor of the scion and may promote production of more root suckers. We know that some rootstocks produce more suckers than others. I don't have a solution for avoiding or managing suckers, but everyone should recognize that suckers pose a threat to tree health.

Figure 2. Root sucker forest around an older tree.

3. Burr knots: Burr knots have always posed problems on some rootstocks, but they become even more problematic on trees that are planted with 6 to 8 inches of the rootstocks exposed. Trees with two or three strategically located burr knots often have distorted trunks

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(Fig. 3). Burr knots are especially attractive to dogwood borers. Perhaps there are nursery practices that can reduce the incidence of

Figure 3. Burr knots on the rootstocks of trees of varying ages.

burr knots, but growers can help to minimize this problem by avoiding graft unions that are higher than necessary. In some cases, especially if the planting of grass in row middles is delayed until the fall after trees are planted, trees with excessively high graft unions could be bermed slightly after trees have settled, thereby reducing risks that burr knots will develop on the excessively exposed rootstocks.

4. Herbicide injury on trunks: Initially I believed that glyphosate was the cause of most trunk damage on apple trees (see http://www.scaffolds.entomology.cornell.edu/2004/040615.html from 14 June 2004). Glyphosate uptake through trunks is still contributing to trunk injury, but it is becoming apparent that other herbicides, while not translocated throughout the tree as is the case for glyphosate, may still be causing localized damage to trunks (Fig. 4). Gramoxone, glufosinate (Rely), and perhaps other products can be nearly as injurious as glyphosate, especially if trees receive multiple applications each year. I suspect that many herbicides cause a slight desiccation of young bark that is hit by the sprays. Repeated desiccation over several years reduces growth of the low-

Figure 4. Trunk damage from an herbicide other than glyphosate.

er trunk and encourages infection by *Botryosphaeria dothidea*, the white rot pathogen, as explained in the next paragraph. Repeated desiccation sometimes results in decreased trunk diameters just above the graft unions (Fig. 5). Painting trunks with a white latex paint (Fig. 6) appears to protect the trunks to some degree (research needed!). However, it is very difficult to get good paint coverage on the exposed portions of the rootstocks that are often roughened by burr knots and flaky bark. In some cases, we are now seeing rootstocks dying from apparent herbicide damage where the trunks that were protected by white paint appear healthy. Cultivars and rootstocks seem to differ significantly in their susceptibility to damage from herbicides. The only solution here seems to be to paint trunks on young trees, keep graft unions as low as is practical without risking scion rooting, and minimize exposure of trunks

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Figure 5. Trunk with external bark damage and reduced diameter just above the union, presumably caused by repeated herbicide injury.

to ANY and ALL herbicides, especially on trees less than 6 or 8 years old. Trunk guards (such as milk carton sleeves) placed around young trees can minimize herbicide contact with the trunks, but if trunk guards are left in place throughout the year, they may eventually serve to attract and protect borers.

5. Drought injury on trunks: Apple trees subjected to drought stress during summer

Figure 6. Latex paint may reduce herbicide damage on young trees.

will eventually be attacked by *B. dothidea*, an opportunistic fungus that is resident in older bark and that can damage (Fig. 7) and even kill the bark and cambium on trees that are water stressed. When periods of water stress are limited, *B. dothidea* may kill only the outer bark,

Figure 7. Initial phases of *B. dothidea* invading drought stressed bark (bluish gray coloration, left) and trunk damage that results from severe infections (right).

which then peels off in large flakes to reveal healthy, relatively green bark beneath the flakes.

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Recently, Dr. Srdjan Acimovic, plant pathologist at the Hudson Valley Lab, suggested that flaking bark, which is more prevalent on some rootstocks than on others, might expose thin green bark beneath the flakes to herbicides, thereby allowing injury of the green bark that would not occur in the absence of the flaky bark. Thus, herbicide desiccation of bark may favor infection and invasion of *B. dothidea* that then causes more flaky bark that exposes underlying green bark to herbicide damage as the flakes are shed, thus creating a cycle that allows continued damage in older trees. The solution for avoiding drought stress is to ensure that new plantings can be irrigated. I am increasingly convinced that trees on M.9 rootstocks should not be planted on any ground that cannot be irrigated because this rootstock will not survive the drought stresses that will likely become more prevalent throughout the northeastern United States as a result of climate change over the next 20 or 30 years. For those without access to (enough) irrigation water, the million-dollar question is, which of the new rootstocks is best suited for surviving drought stress, and at what spacing should they be used on non-irrigated sites? I'm not sure anyone knows, but I'm fairly certain G.11 will be no better than M.9 on droughty sites because I have already seen severe *B. dothidea* on drought-stressed trees on G.11 at the Hudson Valley Lab.

Figure 8. Raised lenticels symptomatic of manganese toxicity associated with low soil pH.

6. Low pH causing measles (Fig. 8): Most growers are doing a good job of adjusting soil pH prior to planting, but we still see occasional plantings where tree health is jeopardized by low pH. Bringing up soil pH after planting is much more difficult than if it is done prior to planting.

7. Latent viruses: Apple trees can carry four latent viruses that are transmitted only via propagation or by root grafting from adjacent trees. The latent viruses are stem pitting, stem grooving, apple chlorotic leaf spot, and apple mosaic. These latent virus generally do not cause any visible symptoms or direct tree decline, although they can reduce yield in some cultivars. In the earlier part of the 20th century, before these viruses had been identified, apple growers sometimes used Virginia Crab as a rootstock. When apple stem pitting and/or apple stem grooving was introduced into the Virginia crab rootstock by grafting a scion

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cultivar that contained these viruses, the rootstock would develop severe pitting (Fig. 9) that stunted the trees and made them unproductive. Clean nursery stock programs initiated during the 1950s and 1960s pretty much eliminated these virus problems, but those programs gradually were abandoned due to lack of interest and funding. Now tree decline from latent viruses is re-emerging as a commercial problem. It behooves growers to request and insist upon trees that are propagated using virus-free scion material, so as to avoid tree losses several years after planting.

8. Borer problems: Dogwood borer (an old problem) and black stem borer (a newer problem) can devastate trunks on young trees. Dogwood borer is favored by the presence of burr knots that provide entry points and by flaky bark and abundant root suckers, both of which can provide protection from both predators and insecticide sprays. Changing pesticide registrations may make management of these borers more difficult in the future. Failure to monitor carefully for borer problems and apply controls when borers first appear can rapidly lead to tree decline and other trunk problems. There is some question about whether or not borer damage provides entry points for contact herbicides that then contribute to further trunk injury.

Ultimately, good tree health is heavily dependent on having healthy tree trunks. Growers who are investing up to $30,000 per acre in new plantings should be asking tough questions about rootstocks, virus contamination of budwood, recommended planting depths, and why some lots of trees have so many burr knots or produce so many suckers within a few years after planting. Perhaps no one has all of the answers at this point, but we can't expect much progress if no one is thinking about how to improve the key structures (apple trunks) that support all apple production systems. ❖❖

Figure 9. Pitted wood on a section of Virginia crab rootstock that was infected with latent viruses as contrasted with the smooth wood of the Grimes Golden scion (left of the pruning stub in the photo) that showed no effects from the virus. Thanks to David Doud, Countyline Orchard, Wabash, Indiana, for providing the wood sample from his woodshed archives.

COOLING IT

INSECTS

TRAPPED OUT

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

❖❖ With this issue, Scaffolds ceases publication for the season; we expect to start up again next March. In March, as usual, we'll send out an email to all current subscribers to verify addresses for next year's mailing list. Our thanks to all of you who have sent comments, suggestions, and articles our way, a practice we hope you'll continue. As a wrap-up, here's our annual summary of the year's pheromone trap results and an Index of Volume 25, 2016 of Scaffolds Fruit Journal.

KEY = GFW - Green Fruitworm; RBLR - Redbanded Leafroller; STLM - Spotted Tentiform Leafminer; OFM - Oriental Fruit Moth (in apples); LAW - Lesser Appleworm; CM - Codling Moth; APB - American Plum Borer (in peach); LPTB - Lesser Peachtree Borer (in peach); DWB - Dogwood Borer; PL - Pandemis Leafroller; OBLR - Obliquebanded Leafroller; PTB - Peachtree Borer; AM - Apple Maggot; * - first catch of the generation.

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Geneva Pest Trapping Results - Avg/Trap

DATE	GFW	RBLR	STLM	OFM	LAW	CM	SJS	APB	LPTB	OBLR
3/25	1.0*									
3/28	8.5									
4/7	14.0									
4/11	16.0	0.0								
4/15	11.5	0.5*	0.0							
4/18	9.5	23.0	1.0*							
4/22	19.5	114.5	62.5							
4/25	18.0	26.5	2.5							
4/29	6.0	9.5	0.0	0.0						
5/2	1.5	14.5	12.0	3.5*						
5/5	0.5	37.0	64.0	5.5						
5/9	3.0	11.5	40.0	5.5						
5/12	0.0	31.0	22.0	31.0						
5/16	0.0	21.0	18.0	19.5						
5/20	0.5	19.5	20.5	11.0	0.0	0.5*				
5/23	0.0	26.5	36.0	31.5	0.5*	2.5				
5/26		21.5	15.0	29.5	0.0	11.5	3.0*	1.0*	12.5*	
5/31		10.0	3.0	29.5	4.5	15.5	3.0	0.0	13.0	3.0*

DATE	RBLR	STLM	OFM	LAW	CM	SJS	LPTB	OBLR	DWB	PL	PTB	AM
6/3	0.0	1.0	5.0	2.5	5.0	0.5	18.5	1.5	2.5*	1.0*		
6/6	0.0	1.5	4.5	3.0	2.5	0.0	8.0	1.0	2.0	5.5		
6/9	0.0	0.0	0.0	0.0	0.5	0.5	0.5	1.0	0.5	2.0		
6/13	0.0	1.5	0.0	0.5	1.0	0.0	4.5	2.0	-	31.0		
6/16	0.0	9.0	0.0	2.0	2.0		3.0	3.0	1.5	1.5	1.0*	
6/21	12.5*	19.5	0.0	1.0	7.5		3.5	27.0	5.0	8.5	7.0	
6/24	1.5	31.5	0.5	1.0	0.0		0.0	8.5	8.0	1.5	4.5	
6/27	9.0	78.0	4.0	1.5	11.5		0.5	7.0	15.5	3.0	1.0	
6/30	8.0	123.0	0.0	0.0	2.0		1.5	2.0	30.0	2.0	2.5	
7/5	8.0	158.0	1.0	0.0	3.5		0.5	0.0	23.5	1.0	3.0	0.0
7/8	6.5	182.5	2.5	0.5	1.0		0.0	3.0	8.0	0.0	9.5	0.3*
7/11	2.5	42.5	3.5	0.0	0.0		0.0	0.5	8.0	0.0	3.0	0.0
7/15	19.5	73.0	0.0	0.0	0.5		0.5	0.0	0.0	0.0	6.0	0.0
7/18	9.5	53.0	0.0	0.0	4.5		0.0	0.0	0.5	0.0	0.0	0.0
7/25	11.0	31.0	0.0	1.0	24.0		0.0	0.0	0.0	0.0	0.5	0.7
7/28	2.5	26.5	0.0	1.0	5.0		1.0	0.0	1.0	0.0	0.5	0.3
8/1	0.0	112.0	4.5*	5.0	8.0		0.0	0.0	0.0	0.0	4.0	3.3
8/5	1.5	78.5	5.0	2.5	5.5		1.5	0.0	0.5	0.0	4.0	3.0
8/8	2.0	48.0	1.0	0.0	4.5		4.0	0.5	0.0	0.5	1.0	0.0
8/12	8.5	57.0	9.5	2.0	7.5		5.5	1.0	0.0	0.5	4.0	0.3
8/15	25.0	39.0	4.0	1.5	11.0		3.5	1.0	1.0	0.0	5.5	0.3
8/19	19.0	40.0	3.0	4.5	8.5		4.0	0.0	0.0	1.0	2.0	0.3

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Geneva Pest Trapping Results - Avg/Trap (contd.)

DATE	RBLR	STLM	OFM	LAW	CM	LPTB	OBLR	DWB	PL	PTB	AM
8/25	19.0	24.5	4.0	2.0	7.5	1.5	0.0	0.0	0.5	3.0	0.3
8/29	6.5	5.5	2.0	0.0	2.0	3.0	0.5	0.0	0.0	0.0	1.7
9/2	4.0	6.0	5.5	1.5	1.5	1.0	0.5	0.5	0.5	0.0	2.0
9/6	1.0	7.0	5.5	0.5	2.0	0.5	0.0	0.0	0.5	0.0	1.0

HUDSON VALLEY INSECT KEY = GFW - Green Fruitworm; RBLR - Redbanded Leafroller; STLM - Spotted Tentiform Leafminer; OFM - Oriental Fruit Moth (in apples); LAW - Lesser Appleworm; CM - Codling Moth; SJS - San Jose scale; DWB - Dogwood borer; OBLR - Obliquebanded Leafroller; AM - Apple Maggot; * - first catch of the generation.

Hudson Valley (Highland) Pest Trapping Results - Avg/Trap

DATE	GFW	RBLR	STLM	OFM	LAW	DWB	SJS	CM	OBLR	AM
3/14		1.0*								
3/21	0.4*	0.5								
3/28	7.0	26.0								
4/4	0.0	4.5	20.5*							
4/11	1.0	12.5	6.5							
4/18	0.5	45.0	136.5							
4/25	1.5	151.0	678.0							
5/2	0.5	28.0	89.0	13.0*						
5/9	1.0	18.0	53.0	19.0	2.0*					
5/16	0.0	19.0	25.5	27.5	17.5	1.0*	513.5*			
5/23		3.0	17.5	4.5	2.0	0.0	2.0	35.0*		
5/31		1.0	1.5	0.5	5.0	1.0	32.0	71.0	4.5*	
6/6		0.0	60.0	1.0	4.0	2.0	0.0	44.5	21.0	
6/13		0.5	96.0	0.0	1.0	1.1	0.0	35.5	41.5	
6/20		8.5	327.0	0.5	7.5	0.0	0.5	48.5	62.5	
6/27		39.0	255.5	3.5	21.5	1.5	10.0	31.5	63.0	
7/5		45.0	214.5	4.5	25.0	9.5	1.5	7.5	22.0	
7/11		21.5	119.5	10.0	10.0	5.0	2.5	32.5	11.0	2.8*
7/18		14.5	60.5	3.5	4.0	5.5	15,680	69.0	5.5	4.3
7/25		3.5	151.0	1.5	9.0	2.5	3696	52.0	10.0	7.8
8/1		6.0	132.0	6.5	15.5	6.5	70.0	61.0	14.0	11.0
8/8		11.5	56.0	8.5	14.5	2.0	35.5	40.0	12.0	5.0
8/15		38.5	74.0	14.0	26.0	8.5	9.0	41.5	14.5	14.8
8/22		18.0	13.0	8.5	19.5	4.5	481.5	20.0	11.5	4.8
8/29		36.5	13.5	11.0	36.5	1.5	107.5	12.0	11.0	8.0
9/6		33.5	38.5	18.5	35.5	1.0	73.0	13.5	10.0	7.3

GENERAL INFO

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INSECT TRAP CATCHES (Number/Trap)

Geneva, NY

	8/29	9/2	9/6
Redbanded leafroller	6.5	4.0	1.0
Spotted Tentiform Leafminer	5.5	6.0	7.0
Oriental Fruit Moth	2.0	5.5	5.5
Lesser Apple Worm	0.0	1.5	0.5
Codling Moth	2.0	1.5	2.0
Lesser Peachtree Borer	3.0	1.0	0.5
Obliquebanded Leafroller	0.5	0.5	0.0
Pandemis Leafroller	0.0	0.5	0.5
Dogwood Borer	0.0	0.5	0.0
Peachtree Borer	0.0	0.0	0.0
Apple Maggot	1.7	2.0	1.0

Highland, NY

	8/29	9/6
Redbanded leafroller	36.5	33.5
Spotted Tentiform Leafminer	13.5	38.5
Oriental Fruit Moth	11.0	18.5
Lesser Appleworm	36.5	35.5
San Jose Scale	107.5	73.0
Codling Moth	12.0	13.5
Obliquebanded Leafroller	11.0	10.0
Dogwood Borer	1.5	1.0
Brown Marmorated Stink Bug	0.0	0.0
Apple Maggot	8.0	7.3

UPCOMING PEST EVENTS

	43°F	50°F
Current DD accumulations (Geneva 1/1–9/6/16):	3354	2360
(Geneva 1/1–9/6/2015):	3082	2136
(Geneva "Normal"):	3235	2237
(Geneva 1/1-9/12, predicted):	3531	2495
(Highland 1/1–9/6):	3918	2794

Coming Events:	Ranges (Normal ±StDev):	
American plum borer 2nd flight subsides	2927-3353	2018-2372
Codling moth 2nd flight subsides	2846-3462	1923-2447
Lesser appleworm 2nd flight subsides	2794-3488	1918-2422
Lesser peachtree borer flight subsides	2996-3446	2017-2433
Obliquebanded leafroller 2nd flight subsides	3108-3468	2126-2448
Oriental fruit moth 3rd flight subsides	2928-3412	1978-2310
Redbanded leafroller 3rd flight subsides	3124-3436	2142-2422
Spotted tentiform leafminer 3rd flight subsides	3244-3480	2258-2462

all DDs Baskerville-Emin, B.E.

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