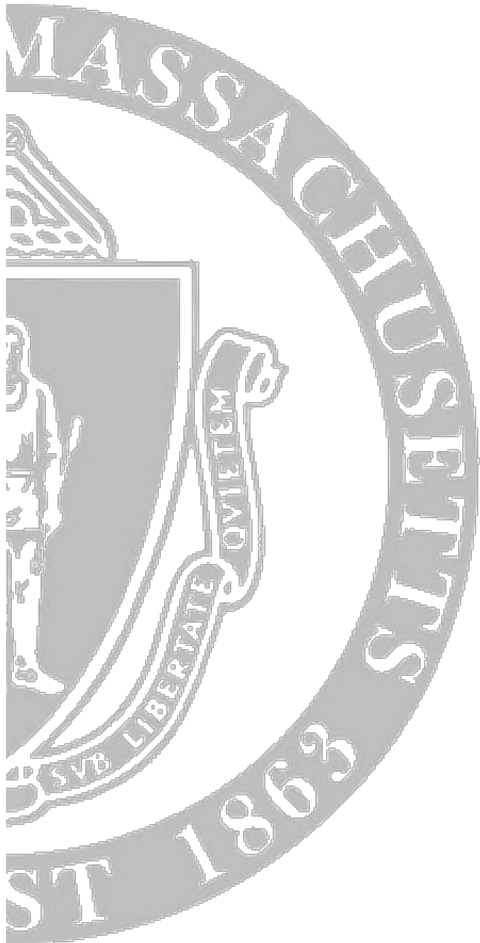


Tactics for Apple Scab Management in 2016



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New England apples

- Six states – apple production about 25% of that in Michigan
- Estimated value of \$70 million on 11,000 acres
- Small orchards, significant direct sales market
- IPM used at least to some extent in most orchards



Pest complex similar

- Major annual disease problem is scab
- Fire blight increasingly damaging
- Powdery mildew, sooty blotch / flyspeck, and summer rots also becoming more common problems



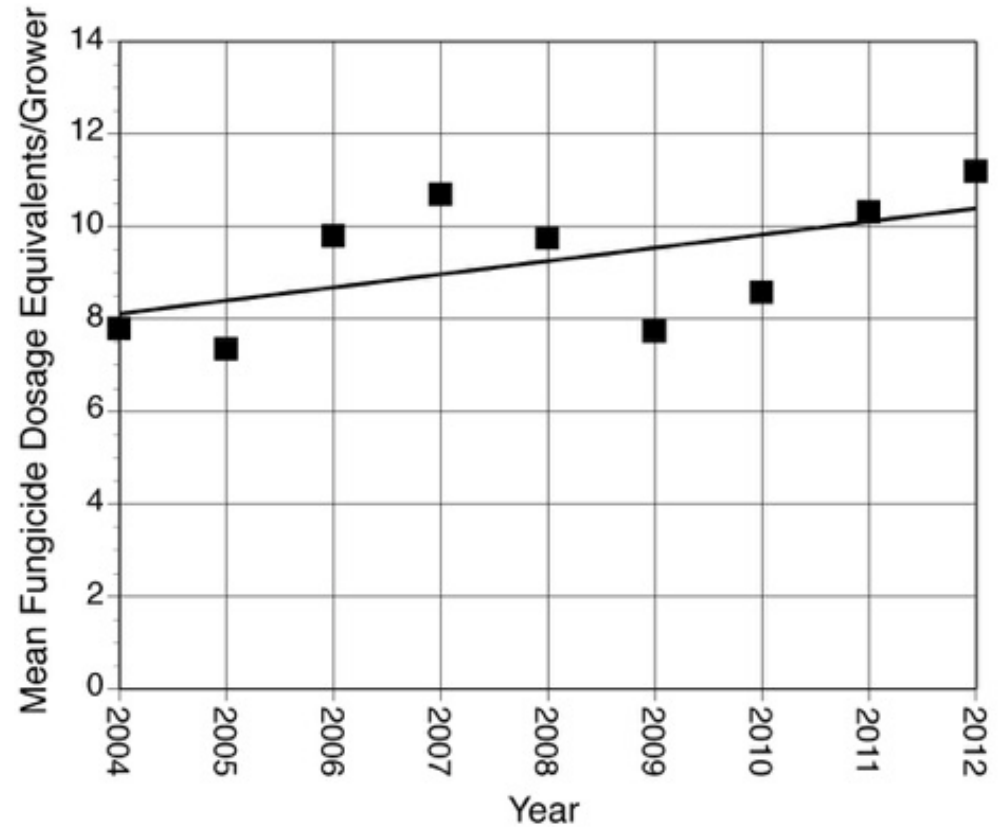
Tactics or strategy?

- Every year we need an overall plan to effectively manage scab
- Be efficient in fungicide use
- In the longer run, need to preserve fungicide efficacy – limit resistance development



Fungicide sprays increasing

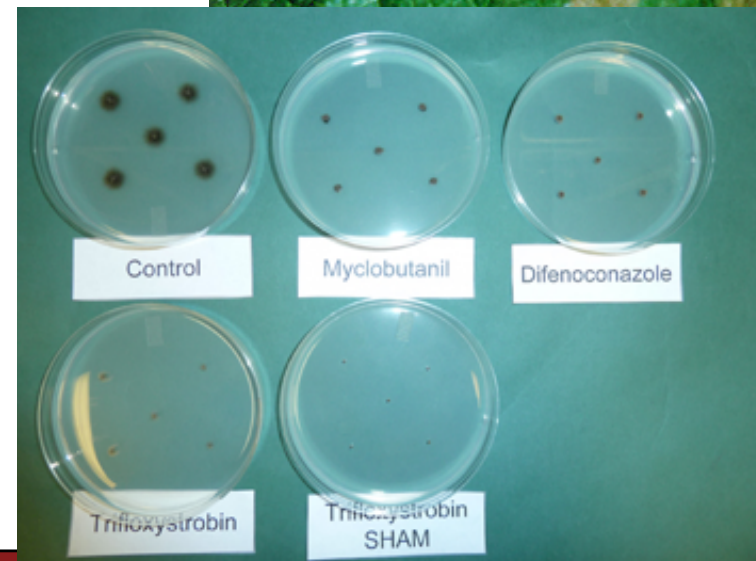
- Recently some growers in New England have approached season limits on captan use
- 40 lb/A Captan 80
- Both amounts of fungicide and numbers of sprays are increasing



Dosage equivalent is one spray at the full label rate

Fungicide use in apples - 2000' s

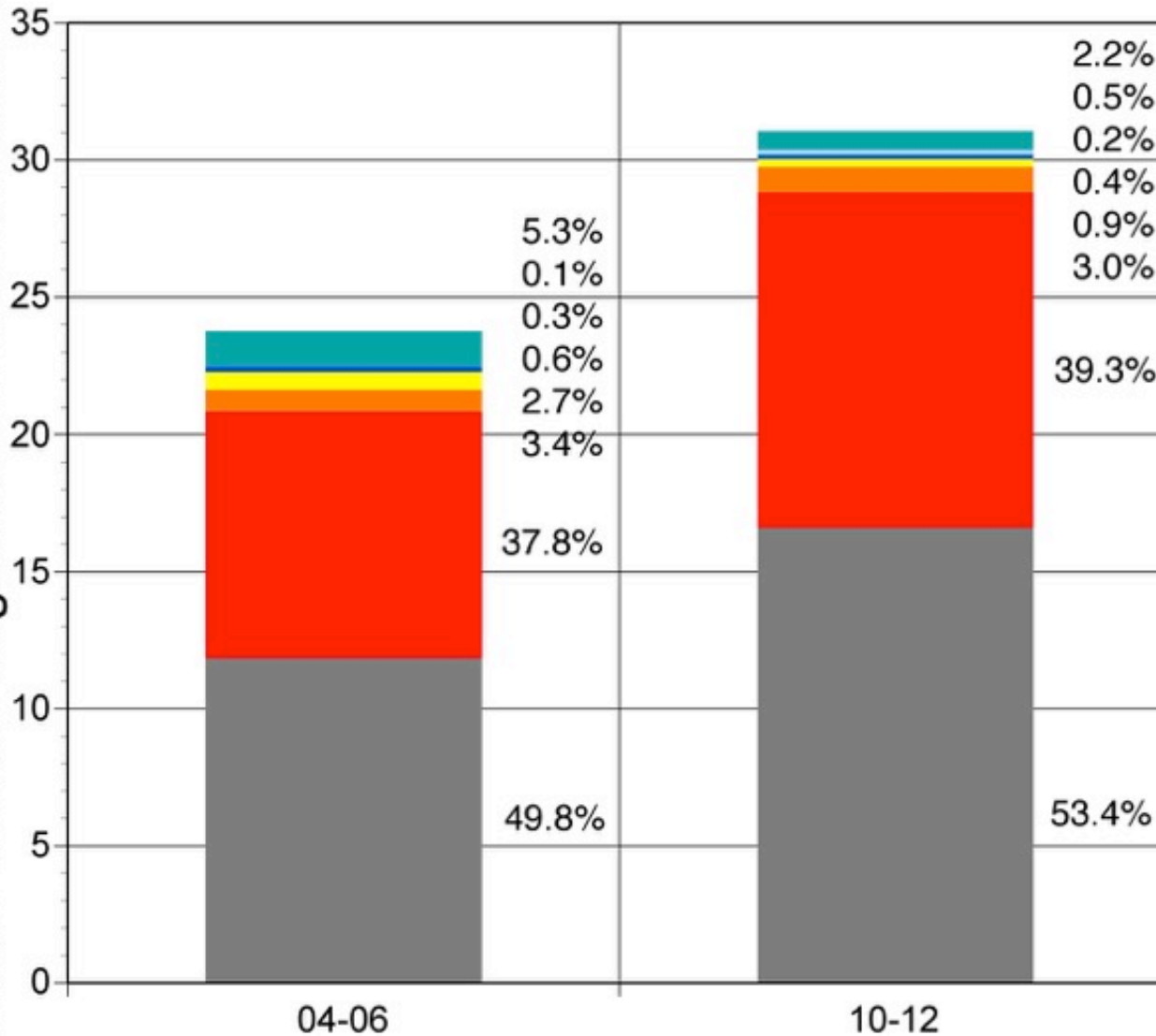
- Remember the 10-day DMI program?
- Selected for DMI resistance
 - Vintage, Rally, Procure, Indar, Inspire, Topguard
- New England survey over 2004 – 2012 showed over 75% of orchards with high or developing DMI resistance (Villani et al.)



The captozeb solution

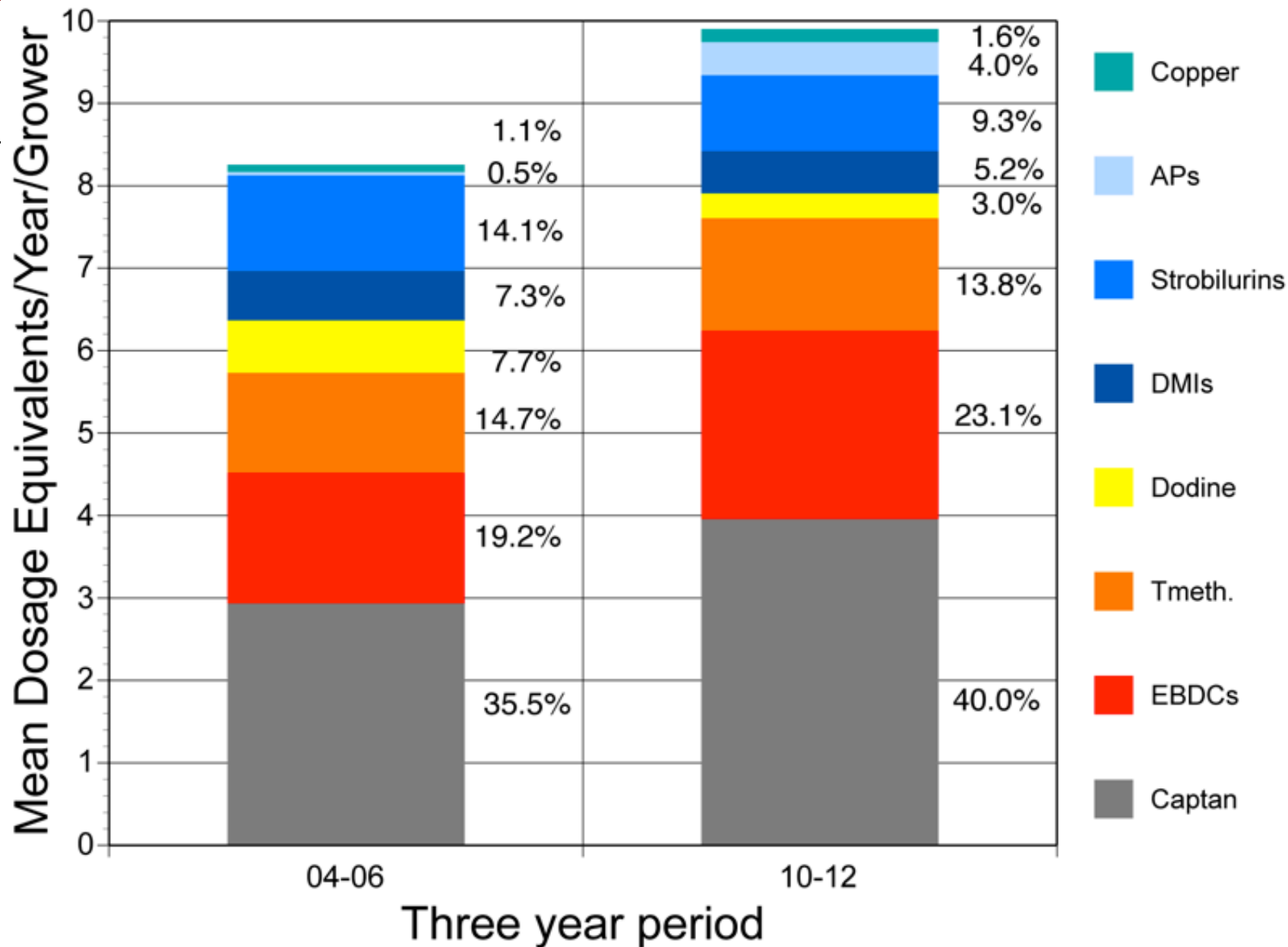
- Resistance to Qol's or strobilurin's also found
 - Flint, Sovran
- Mix of captan plus an EBDC fungicide such as mancozeb was recommended and widely used
 - Dithane, Manzate, Penncozeb, *Polyram*
- Contact fungicides, multi-site action, no resistance issues
- Relatively inexpensive

Mean Pounds Fungicide A.I./Acre/Year/Grower



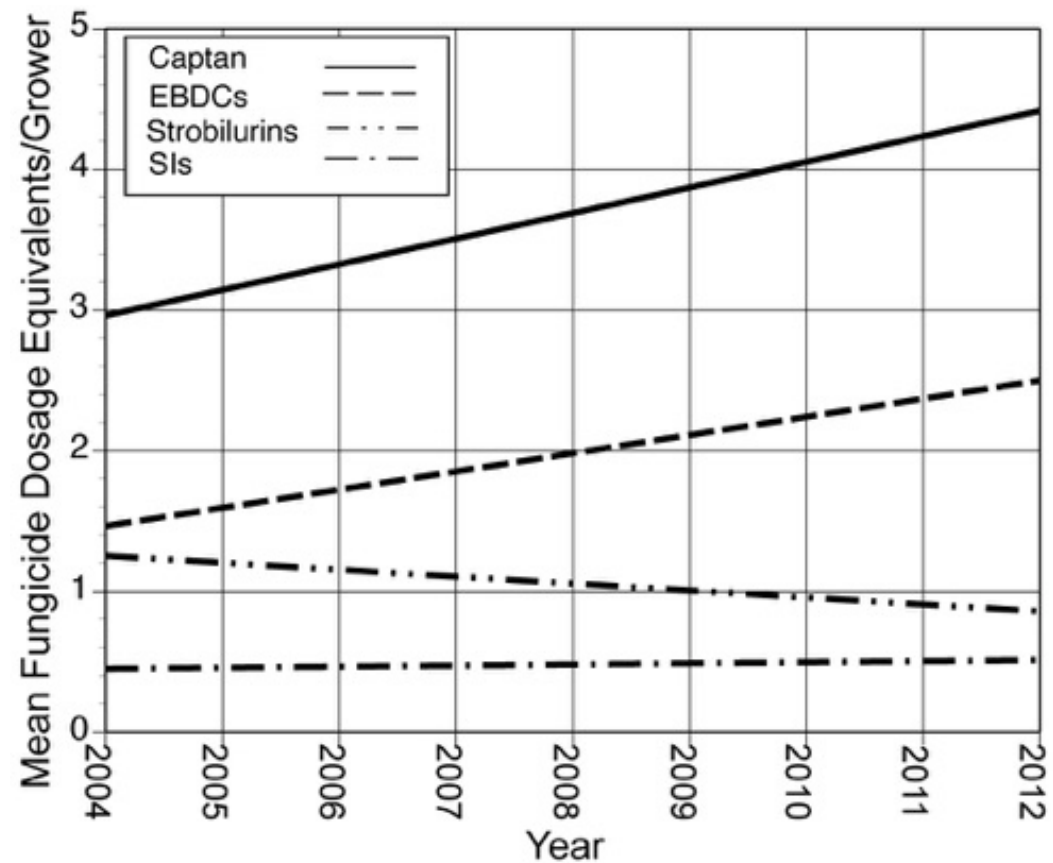
- Copper
- APs
- Strobilurins
- DMIs
- Dodine
- Tmeth.
- EBDCs
- Captan

Three year period



Widely adopted in New England and eastern NY

- However ...
- Does not control powdery mildew
- Protectant – limited post-infection activity to cover mistakes
- Needs to be reapplied frequently
- Generally recommended for “clean” orchards
- Recent issues with fruit and leaf damage



Typical fungicide program 2004-05

Fungicide	EIQ	AI	Lb/A	Uses	Total
Kocide	33.3	0.45	7	1	21
Captan 80WDG	15.8	0.8	2	4	101
Captan 80WDG	15.8	0.8	2.5	1	32
Captan 80WDG	15.8	0.8	1	2	25
Penncozeb 80DF	14.6	0.8	3	2	70
Polyram 80DF	40	0.8	3	1	96
Syllit 65WG	22	0.65	1	1	14
Rally 40WSP	33	0.4	0.25	1	3
Flint	30.9	0.5	0.125	1	2
Topsin M 70WDG	22.42	0.7	0.75	3	35
Total				17	400

EIQ up by

Typical fungicide program 2011-12

Fungicide	EIQ	AI	Lb/A	Uses	Total
Kocide	33.3	0.45	7	1	105
Captan 80WDG	15.8	0.8	2.5	3	95
Captan 80WDG	15.8	0.8	2	2	51
Captan 80WDG	15.8	0.8	1	3	38
Penncozeb 80DF	14.6	0.8	3	3	105
Polyram 80DF	40.0	0.8	3	1	96
Syllit 65WG	22.0	0.65	1	1	14
Rally 40WSP	33.0	0.4	0.2	1	3
Flint	30.9	0.5	0.125	1	2
Topsin M 70WDG	22.4	0.7	0.75	3	35
Inspire Sup. cyprodinil	21.9	0.24	0.09	1	0
Inspire Sup. difenoconazole	48.7	0.08	0.09	1	0
Total				21	544

EIQ up 36%

The current situation

- Growers use captozebe only as part of scab season management plan – newer materials important
- DMI's, QoI's, SDHI's or AP's at others
 - SDHI's – Fontelis, Aprovia, pre-mixes Luna Sensation, Luna Tranquility, Merivon
 - AP's – Vangard, Scala
- Primary consideration scab risk
- Risk of other diseases
- Manage resistance

Scab initial inoculum

- Scab epidemics start on the orchard floor -
- Infected leaves carry scab through the winter
- At about green tip, inoculum just starts to mature and get ready for release in rains
- Ascospores keep maturing and releasing until fruit are set and begin to grow



Overwintering inoculum

- Overwintering inoculum has become a larger problem in recent years.
- Mistakes with protectants
- So?
- More ascospores
- More early season-ascospores
- “Light” infection periods become important
- Overall scab risk increases



Orchard sanitation – every year

- Orchard sanitation destroys overwintering scab inoculum in orchards
- Less scab inoculum reduces risk of primary infection, particularly early in the season
- Less chance of a mistake having serious consequences
- Less chance of resistance development



But I didn't have any scab last year!

- Fruit scab not well correlated with inoculum in leaves
- DMIs are fungistats not fungicides
- Scab may reactivate on leaves in fall
- Few growers or consultants scout overwintering inoculum – Potential Ascospore Dose or PAD



Won't scab inoculum come in from outside my orchard?

- 99.99% travels no more than 100 ft.
- Large sources mean some may be a problem because 0.01% of a lot of inoculum may be enough to infect
- Know what's around an orchard – e.g. abandoned blocks



But it's an extra expense and haggle without definite return

- Sanitation costs about as much as a scab spray
- Leaf chopping alone is least expensive, still gives significant reduction
- "If an extra spray would significantly reduce scab risk, and also help maintain efficacy of new fungicides, would I use it?"

Sanitation Treatment	Cost/A	80 A Orchard
Urea treatment	\$60	\$4,800
Leaf chopping	\$10	\$800

Benefits of sanitation

Chopping leaves



50%
to
95%

Urea spray



50%
to
75%

Both



70%
to
95%

Leaf chopping

- Can chop leaves in fall or spring
- Spring flips leaves over eliminating on average 50% of inoculum immediately
- Get as much of the leaf cover as you can – rake to row middles
- Allow time for microbes, earthworms, to break down leaves



Eliminé flail chopper -Vincent Phillion

Urea treatment

- Mix 40 lb. feed grade urea in 100 gal. / A
- Apply in fall just before leaf fall
- Can apply in fall or early spring to leaves on ground but not as effective
- Allows less time for microbes, earthworms, to degrade leaves
- Supplies approx. 20 lbs. actual N / A – adjust fertilizer



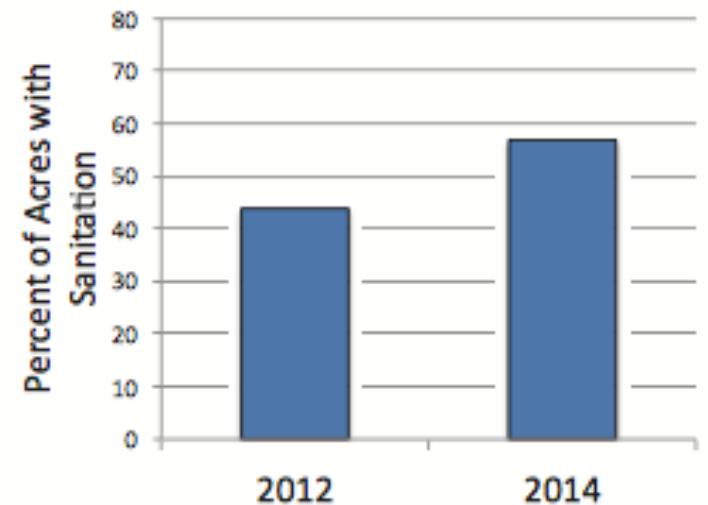
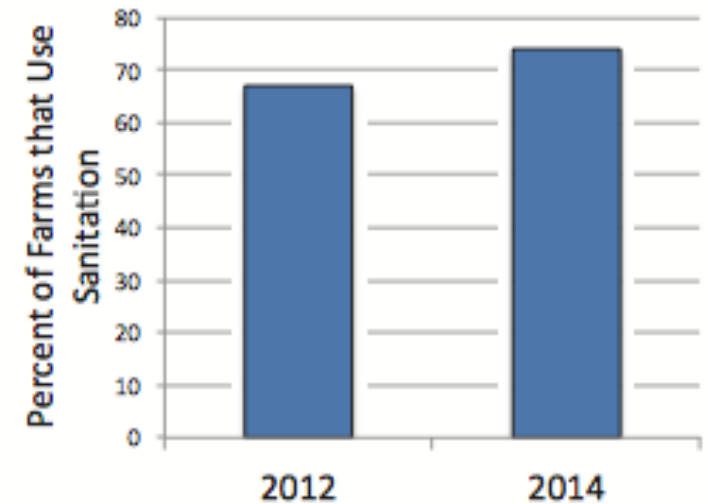
But won't fall N decrease winter hardiness?

- No – evidence is to the contrary - it may enhance bud health next spring
- For ex. cherry work by Greg Lang
- But whether urea is used, or only chopping, sanitation is highly recommended
- Think of it as killing off scab

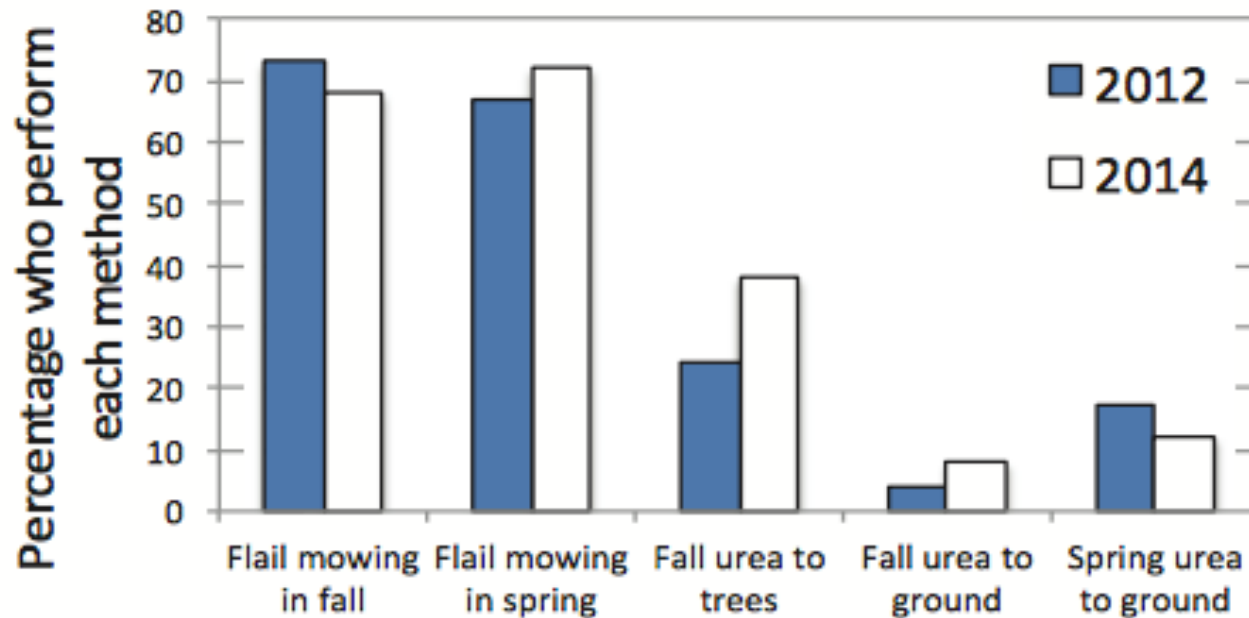


New England growers use sanitation

- Survey of New England growers from 2012, repeated 2014
- Most New England apple growers use some form of orchard sanitation for scab
- Acres increasing
- Most common reason for not doing – lack of time when it needed to be done



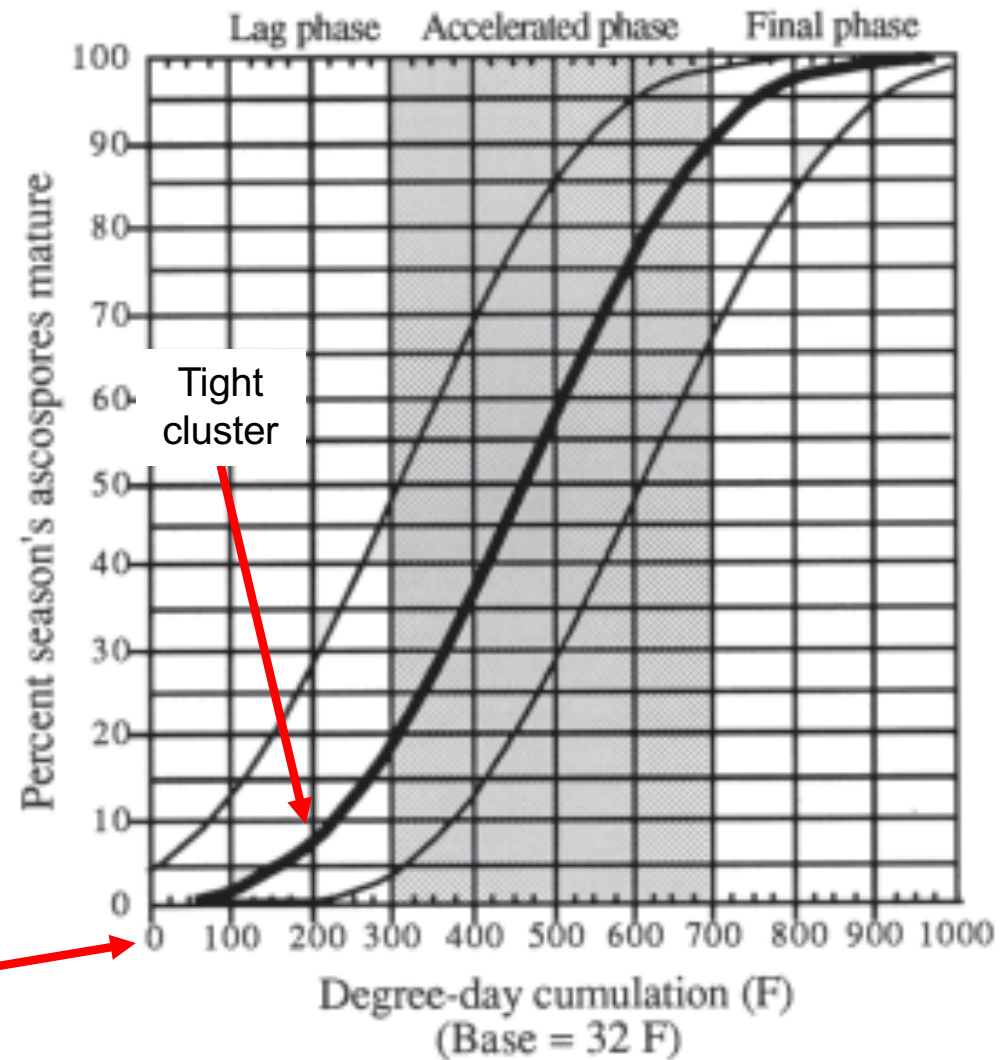
Majority use flail chopping though urea increasing



- Most common method is flail mowing fall and spring
- Fall urea to trees is increasing

Delay the first scab fungicide?

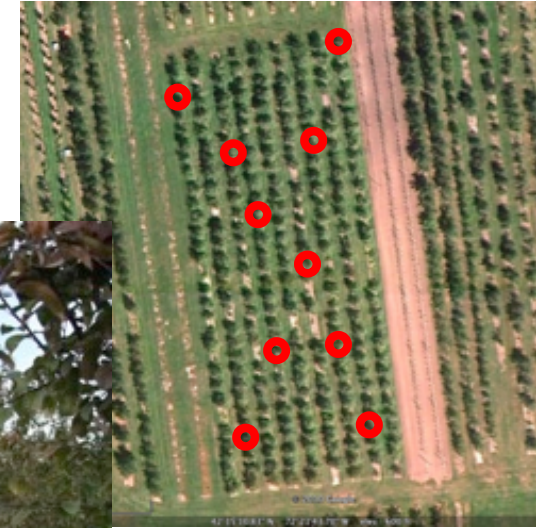
Because the fraction of the total scab inoculum released for the season is very low early, in a very low inoculum orchard it may be possible to delay the first fungicide for scab.



Green tip

Need to accurately measure primary inoculum

- Potential ascospore dose
– PAD
- Leaves on trees are systematically sampled after harvest in the fall
- Mean evaluation time for 2 to 10 acre blocks is 33 min.
- Combine with sanitation



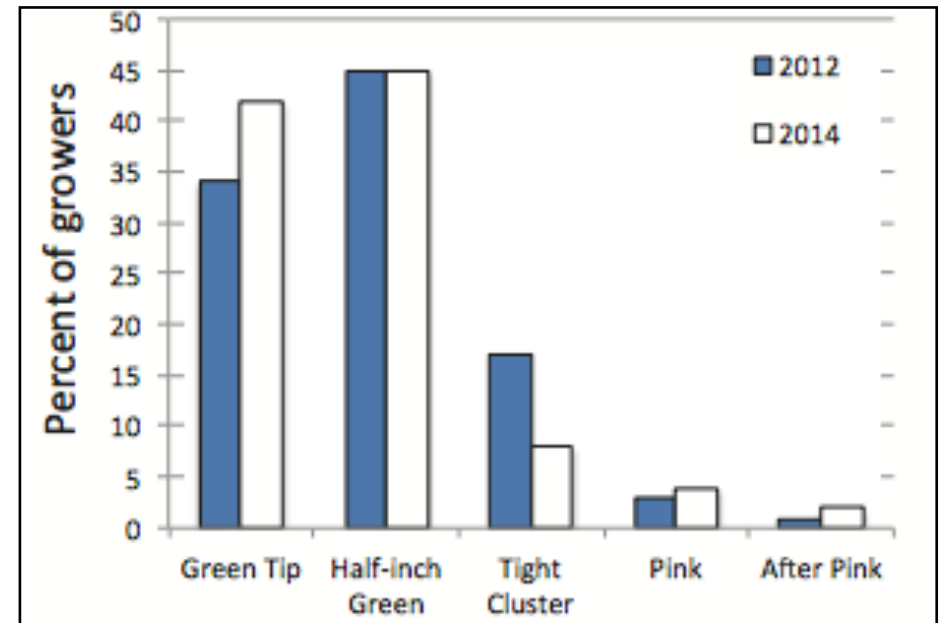
PAD-based delay results 2008-2013

Year	Delay blocks	Mean delay days (growth stage)	Mean infection periods	Harvest scab delay	Harvest scab check
2008	7	-	-	0.1%	2.2%
2009	9	9 (tight cluster)	1.7	3.6%	10.3%
2010	5	8 (tight cluster)	1.2	0.8%	0.4%
2011	6	6 (tight cluster)	1.7	0.6%	1.5%
2012	12	20 (pink to bloom)	0.7	0.7%	0.1%
2013	10	8 (pink)	0	0.5%	1.5%

- In 49 test blocks, all delay treatments had less fruit scab at harvest than checks.
- Saved 1 to 3 fungicide applications.

Little scab indexing (PAD) or delay of first spray

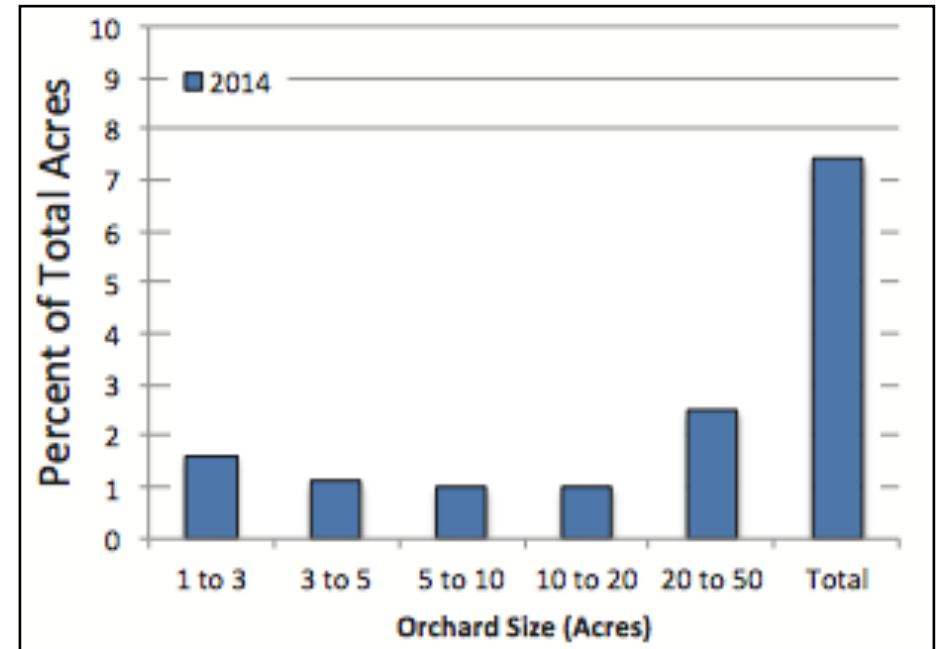
- 2012 - 15% of surveyed growers did PAD
- 2014 – 24%
- Why not?
- Too little time
- Did not know how to do it
- Of marginal value?



Growth stage when the first non-copper fungicide was applied by growers. Some growers delay on part of the farm, not on others. Only 15% delayed to tight cluster or longer.

Little scab indexing or delay

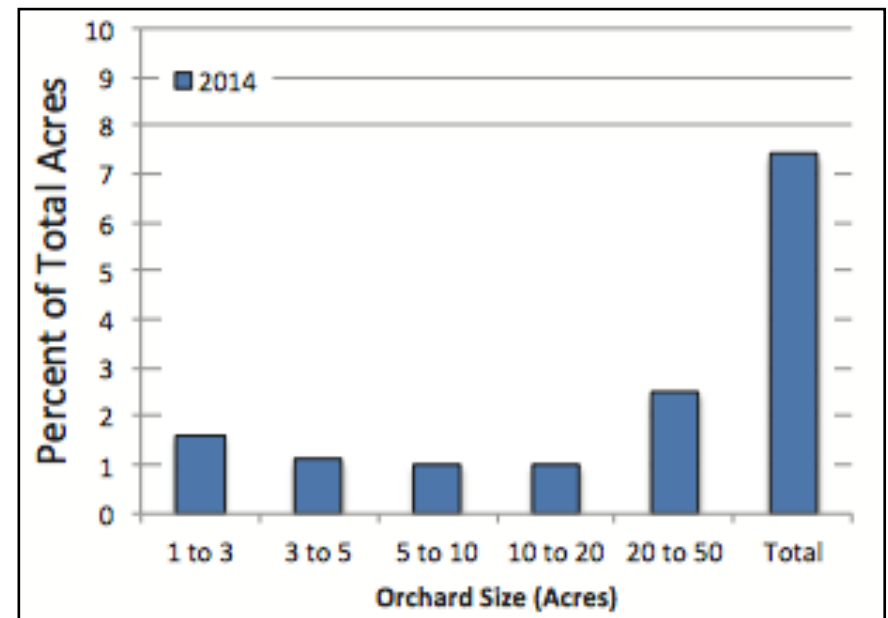
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Percent of acres where the first non-copper fungicide was delayed to tight cluster or later - 7% of orchard acres.

Little scab indexing or delay

- 2012 - 15% of surveyed growers did PAD
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Percent of acres where the first non-copper fungicide was delayed to tight cluster or later.

Issues with skipping an early sprays

- An early-season mistake can cause worse disease than a late-season mistake
- Savings on even three fungicide applications may not justify risk of a scab outbreak – may take several seasons to reduce inoculum levels
- Scab outbreaks breed pathogen resistance
- Ascospore maturity model used to estimate the amount of available inoculum does not perform well in dry conditions

Thanks

This work was made possible by a grant from Northeast SARE and was a collaboration of Extension and University professionals from New England.



Thanks also to the growers who took on the challenge of trying this approach.

And of course Arthur Tuttle who has worked so hard getting this information.

