UMassAmherst

Using multi-cultivar grafted trees as perennial trap crops

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Early-season pests			Summer
Plum curculio	Tarnished plant bug	European apple sawfly	Apple maggot fly

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One note on the application of insecticides against PC

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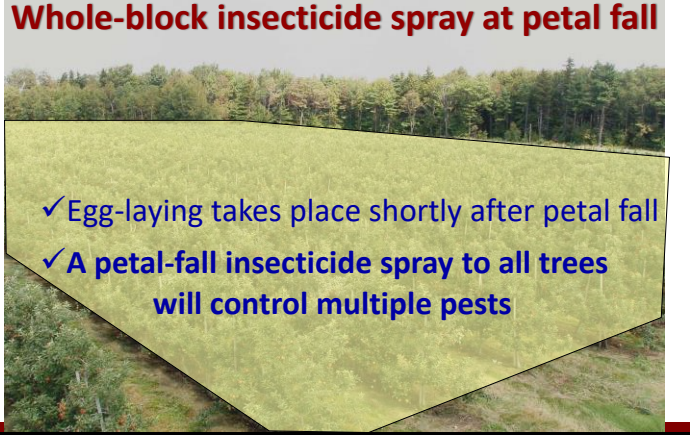
Whole-block insecticide spray at petal fall



- ✓Egg-laying takes place shortly after petal fall
- ✓**A petal-fall insecticide spray to all trees will control multiple pests**

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GROUP 28 INSECTICIDE

Diamide group

VERDEPRYN™ 100SL INSECTICIDE

ACTIVE INGREDIENT: Cyclaniliprole* 9.17%

Labeled against many pests in pome and stone fruit, grapes, berries, etc.

- Most diamide insecticides are **translaminar** and **systemic**.
- Long residual activity and broad-spectrum control.
- **Verdepryn**: **REI**= 4hrs, **PHI**= 7 days (pome fruits)
- **Rainfastness** of diamide insecticides: **HIGH** in fruit (up to 1 inch of rainfall).
- **Rainfastness** of oxadiazine insecticides (AVAUNT): **MODERATE** in fruit (up to 1 inch of rainfall).

Source: Dr. John Wise, Michigan State Univ.

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2021 (UMass) evaluation of Verdepryn for PC control

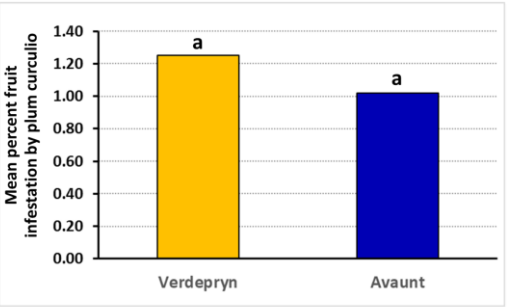

Figure 2. Across six sampled blocks at the UMass CSO, average level of plum curculio injury to sampled fruit according to insecticide type. Same letters above bars denote lack of statistically significant differences between treatments at odds of 19:1.

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One fruit grower in Rhode Island evaluated Verdepryn applied against PC at petal fall.

The level of injury recorded in the June 1st sampling was 0.26%

Work in collaboration with H. Faubert (URI)

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Back on topic….

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Effective commercial lures are available for some pests

Pest	Attractant	Uses	Level of adoption
Plum curculio	Benzaldehyde + grandisoic acid	**Monitoring*** (trap tree)	None
		Control (**attract-and-kill**)	None
Apple maggot fly	5-component blend	Monitoring	Low
		Control (**attract-and-kill**)	None
European apple sawfly	None	-----	-----
Tarnished plant bug	None	-----	-----

*One perimeter-row odor-baited trap tree is an effective approach to determine the need and timing of insecticide sprays against PC **AFTER PETAL FALL**

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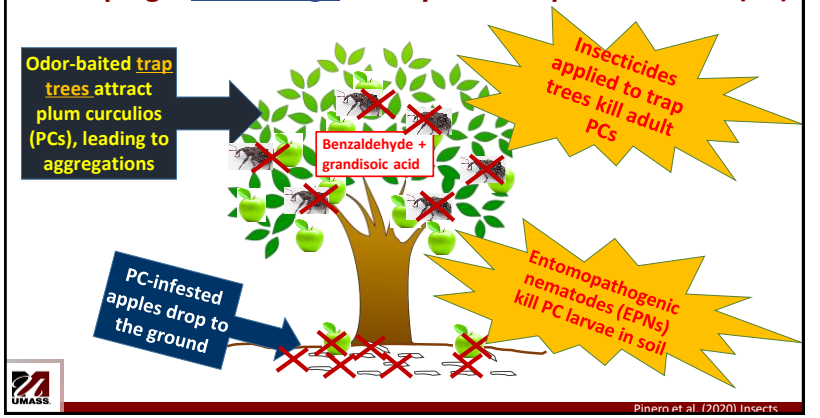
Developing a multi-stage IPM system for plum curculio (PC)



Pinero et al. (2020) Insects

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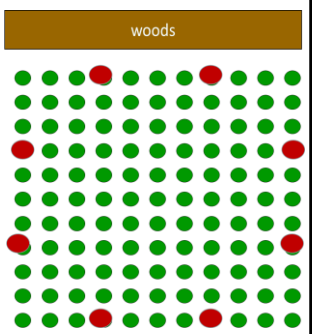
Attract-and-kill (AK) strategy against adult PCs

- **The trap tree approach is effective** (2004-2005 in 2 orchards, 2013-2019 in 6 orchards).
- 70% reduction of insecticide compared with post-petal-fall perimeter-row sprays.
- 93% reduction of insecticide compared with standard full-block sprays.
- While effective, this AK strategy has not been adopted by any grower.



Leskey et al. (2008), Pinero et al. (2020)

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1977 First publication by Ron Prokopy (UMass) on plum curculio (PC)

1982 First PC publications by Canadian group (Lafleur, Racette, Vincent)

2000 I started graduate school at UMass – 5-year research on PC

2018 Returned to UMass

Stephen Wood

Poverty Lane Orchards (Lebanon, NH)

How to make IPM more sustainable?

What kind of research is needed?

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Long-term project: Idea developed in 2018 WITH growers

Developing a permanent, low-cost, trap cropping system for multiple apple pests via *multi-cultivar grafting*

NH collaborators: Jeremy Delisle, Heather Bryant, and Anna Wallingford

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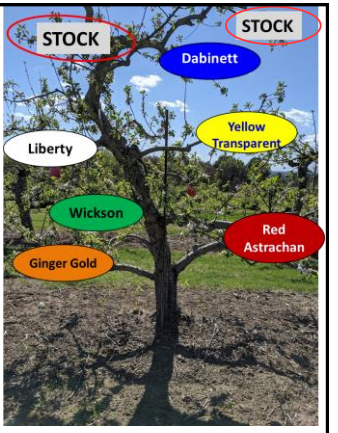
- Each trap tree is grafted with **6 cultivars that are very attractive to PC and apple maggot fly (AMF)**.
- **Research focuses on PC and AMF** and includes European apple sawfly, Tarnished plant bug, and other pests.
- The concept is simple, affordable, and grower-friendly.

Is it effective?



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20+ blocks in MA, NH, and ME

State	Orchard name	Area (in acres) with grafted trees	No. grafted trees	Year grafting done
NH	1. Poverty Lane Orchards	8.8	32	2018
MA	2. UMass CSO – X-block	0.5	4	2018
MA	3. UMass CSO – Empire block	0.2	4	2018
MA	4. UMass CSO – Rock Mountain	1.7	6	2019
MA	5. Clarkdale	2.1	6	2018
MA	6. Nicewicz farm	1.1	4	2018
ME	7. Ricker Hill orchards – block 1	?	?	2018
ME	8. Ricker Hill orchards – block 2	?	?	2019
NH	9. Apple Hill farm	4.8	7	2019
MA	10. Sholan Orchards	7.3	11	2019
MA	11. Tougas farms	0.6	4	2019
MA	12. Ragged Hill Orchard	0.3	3	2019
MA	13. Red Apple Farm	2.9	6	2019
MA	14. UMass campus (Ag. Learning Center)	0.2	3	2019

2020: No grafting.

2021: One more block grafted (MA)

2022: 5 more blocks (NH and ME)

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Results: PC captures in traps and fruit injury in GRAFTED vs. NON-GRAFTED TREES

Distance between grafted trees:
30 meters

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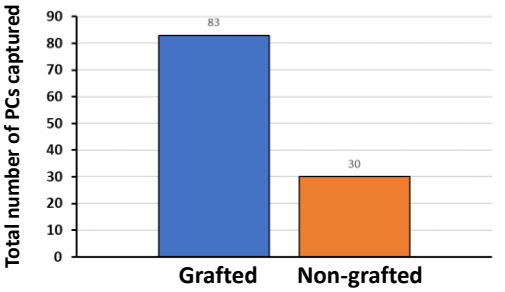
PC captures in traps across all 12 blocks (10 MA, 2 NH)

(early May to early June 2022)

Black pyramid traps



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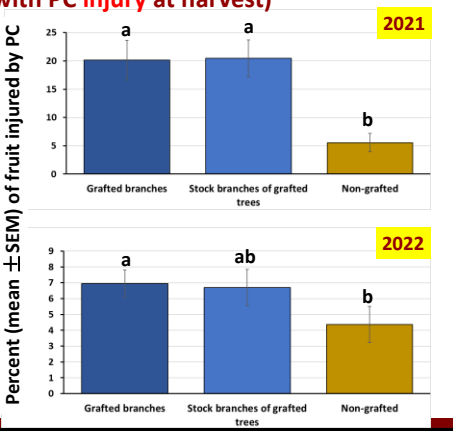
Results (% of fruit with PC injury at harvest)



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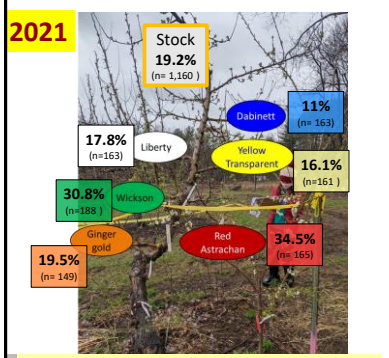
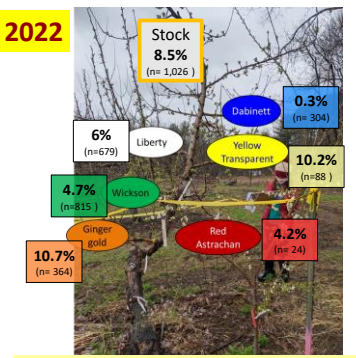
PC INJURY BY CULTIVAR - ALL ORCHARDS COMBINED





- Total # fruit sampled from grafted branches: 989
- Total # fruit sampled from STOCK branches: 1,160

- Total # fruit sampled from grafted branches: 2,274
- Total # fruit sampled from STOCK branches: 1,026

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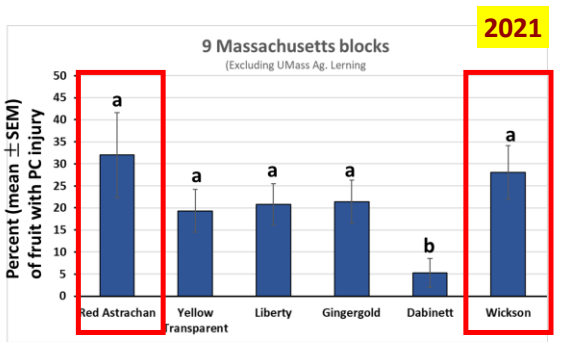
Comparison across cultivars (PC injury at harvest)



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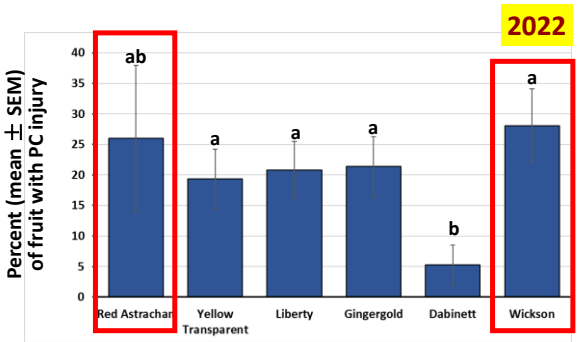

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Conclusion

Multi-cultivar grafted trees are significantly more attractive to PC than single-cultivar trees

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Further development of methods that promote **biodiversity** are expected to reduce chemical inputs (e. g., insecticides), thereby moving towards more sustainable crop production systems.

A single perimeter-row tree grafted with **5 cultivars** per orchard block is expected to serve as an excellent **SENTINEL TREE** for **MONITORING** purposes.

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Acknowledgements

Growers:

- Massachusetts: Tom and Ben Clark, Keith Arsenault, Al Rose, Joanne DiNardo, Ken Nicewicz, Mo and Andre Tougas, Shawn Mcintire.
- New Hampshire: Steve Wood, Chuck Souther (results not shown)
- Maine: Harry Ricker (results not shown)

Collaborators and students:

- Dr. Anna Wallingford, Heather Bryant, Jeremy Delisle (University of New Hampshire)
- Ph.D. students Prabina Regmi (PC) and Dorna Saadat (AMF)
- Jaelyn Kassoy, Ajay Giri

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"We can't solve problems by using the same kind of thinking we used when we created them"

-Albert Einstein