

NW RAMP... A to Z



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Benefits of Sulfur?



- Many MI growers use sulfur to reduce powdery mildew and American brown rot
 - Low cost
 - Is it effective?



- Does sulfur flare two-spotted spider mites?

Impact of Sulfur

- On-farm trial in '06 and '07
- Determined impact on powdery mildew and two-spotted spider mites

RAMP = no Sulfur

Comparison = w/ Sulfur

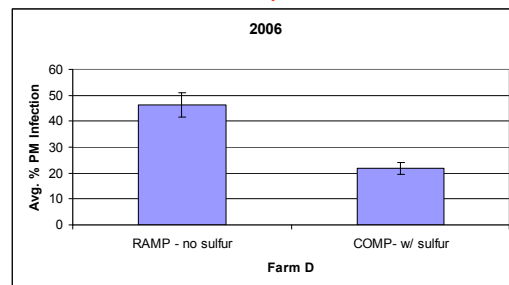


Ramp: 1st spray: Vanguard, 2nd, 3rd, 4th cover: 1.2 actual lb copper/ac (+lime), 5th cover: Pristine, post harvest: 1.2 actual lb copper/ac

Comp: 1st spray: Vanguard, 2nd, 3rd, 4th cover: 1.2 actual lb copper/ac + sulfur, 5th cover: Pristine, post harvest: 1.2 actual lb copper/ac + sulfur

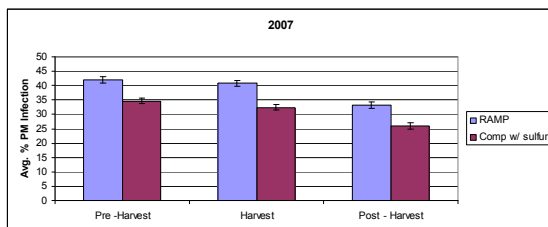


Sulfur and Powdery Mildew, 2006



Season-long sulfur and no sulfur programs combined with standard fungicide program

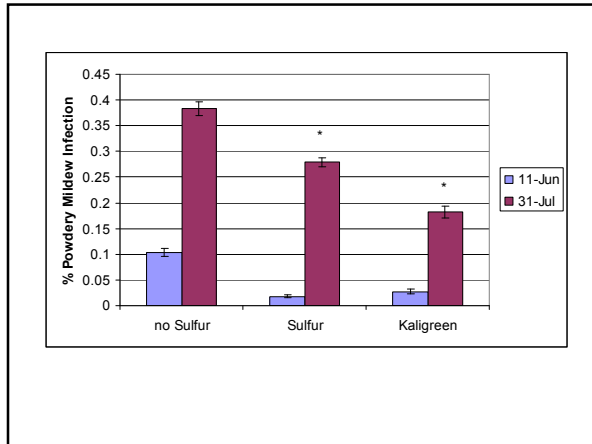
Sulfur and Powdery Mildew, 2007



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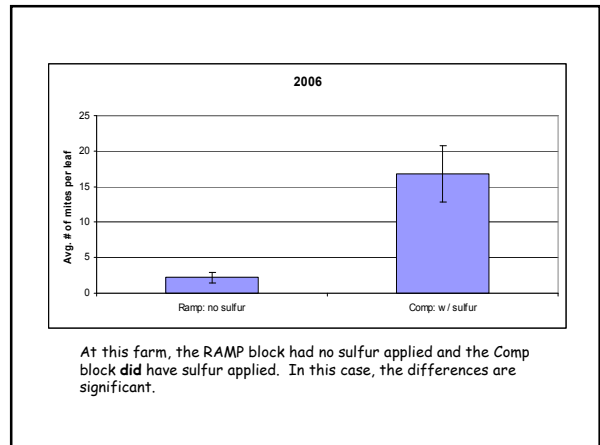
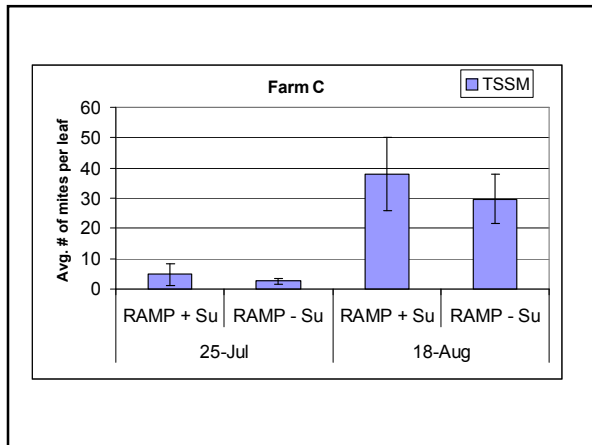
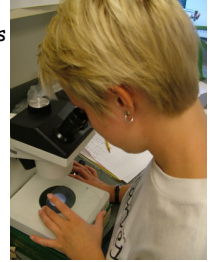
Efficacy of sulfur and Kaligreen® for powdery mildew control

- Compared three programs:
 - **RAMP:** Vanguard, copper/ac (+lime), Pristine, copper
 - **Comparison:** Vanguard, copper + sulfur, Pristine, copper + sulfur
 - **Grower Block:** Vanguard, copper + Kaligreen®, Pristine, copper + Kaligreen®

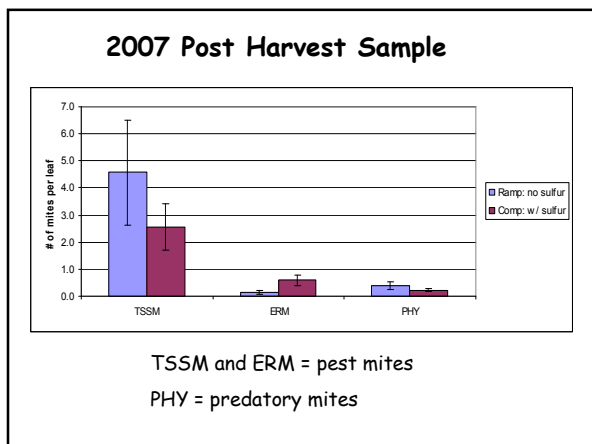


Does Sulfur Flare Two-Spotted Spider Mites?

- RAMP (no Sulfur) vs. Comparison (w/ Sulfur)
- Leaf samples 2x/season
 - Collected 25 leaves from 10 trees
 - Inner, middle, and outer canopy
- Leaves brushed with mite brush onto oil-covered plate
- Number of mites were counted under a microscope



At this farm, the RAMP block had no sulfur applied and the Comp block did have sulfur applied. In this case, the differences are significant.



Do neonicotinoids 'flare' mites?

- RAMP utilizes reduced risk insecticides
 - Actara, newer neonicotinoid
- Neonics flare mites in apple (unpublished data, Gut and McGhee)
- 4 orchards sampled in 2005
 - RAMP: w/ neonicotinoids
 - Comparison: w/o neonicotinoids



Average # of TSSM in NW MI orchards, 2005

Orchard A	Comp	RAMP	Orchard B	Comp	RAMP
6/29/2005	9.00	1.40	6/29/2005	0.45	5.00
7/18/2005	8.21	5.00	7/18/2005	1.21	15.77
8/17/2005	11.76	4.72	8/17/2005	4.56	25.5

Orchard C	Comp	RAMP	Orchard D	Comp	RAMP
6/29/2005	0.12	8.40	6/29/2005	0.95	0.45
7/18/2005	19.34	20.6	7/18/2005	0.0	12.0
8/17/2005	71.23	23.71	8/17/2005	10.67	83.11

¹ Table is average of mites/leaf

² The second and third samples are means of inner, middle, and outer leaves

³ RAMP = neonics; Comparison = no neonics

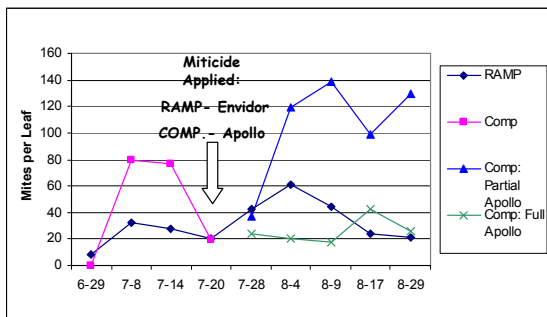
*Orchards B and D had more TSSM with neonics

*Orchards A and C had fewer TSSM with neonics

Efficacy of Envidor for TSSM Control

- Compared Envidor[®] to Apollo[®] for control of TSSM

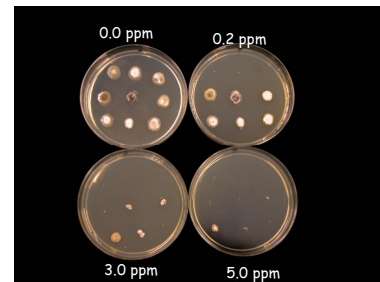
- Compared **every row** to **every other row** application for TSSM control



Impacts of Tank Mixing with Insecticides and Copper/Lime

- Cherry leaf spot isolates were found to have SI resistance
- Investigated fungicide alternatives - Copper!

Sterol inhibitor resistance to CLS



Phytotoxicity with Copper Use



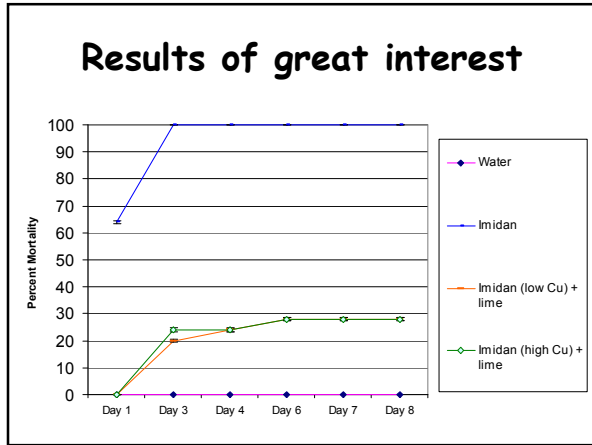
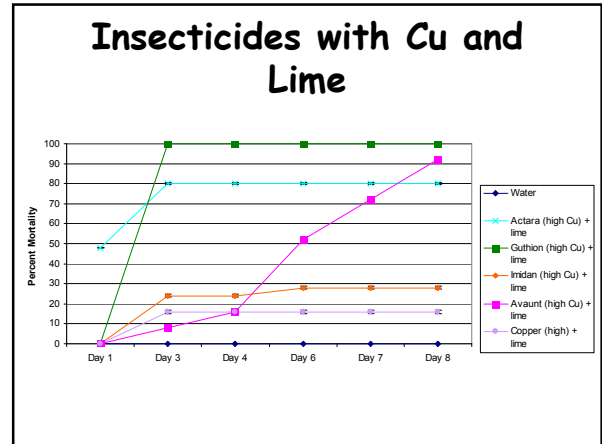
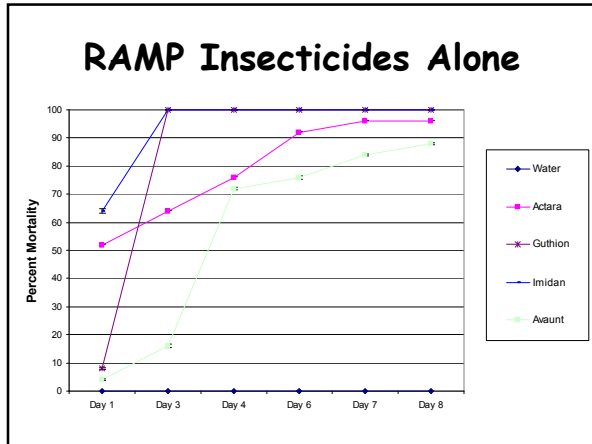
*Recommend lime as safener

*Lime alters pH of water

- Altered pH may impact insecticides in tank mixes
- Laboratory assays
 - 8 insecticides: Asana, Ambush, Actara, Avaunt, Warrior, Guthion, Imidan, Provado
 - Ingestion vs. contact
 - High Cu/high lime
 - Low Cu/low lime
 - Five plum curculio/petri dish

Pathology + Entomology





Time in Days	Day 1	Day 2	Day 3	Day 4	Day 5	Day 7
Control	0%	12%	16%	20%	32%	36%
Actara	68%	92%	96%	96%	100%	100%
Actara (high Cu)	32%	64%	72%	92%	100%	100%
Ambush	64%	95%	100%	100%	100%	100%
Ambush (high Cu)	36%	72%	92%	96%	100%	100%
Asana	36%	92%	100%	100%	100%	100%
Asana (high Cu)	48%	100%	100%	100%	100%	100%
Avaunt	4%	32%	36%	80%	100%	100%
Avaunt (high Cu)	0%	12%	44%	68%	100%	100%
Guthion	36%	88%	100%	100%	100%	100%
Guthion (high Cu)	32%	84%	100%	100%	100%	100%
Imidan	28%	56%	100%	100%	100%	100%
Imidan (high Cu)	8%	8%	8%	8%	8%	8%
Provado	76%	92%	100%	100%	100%	100%
Provado (high Cu)	12%	44%	84%	100%	100%	100%
Warrior	36%	52%	72%	96%	100%	100%
Warrior (high Cu)	4%	64%	84%	96%	96%	96%

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Tank Mix Conclusions

- Lime alters pH of water
- Altered pH affects efficacy of insecticides
- Further Research
 - Do we need lime in spray tank with Cu?
 - Will lime residual on foliage affect insecticides?
 - Do we need to be investigating tank mix efficacy with other products?
 - Ethrel sprays at harvest?

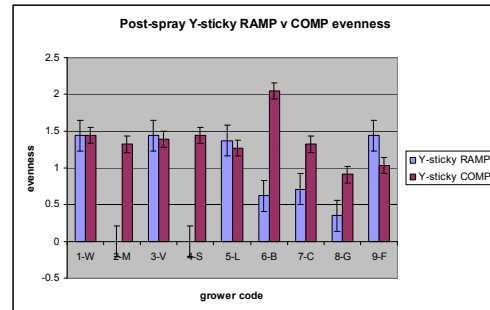


Copper in Tart Cherry Systems

- Copper is effective for CLS control
- What is impact on beneficial insects?
 - In citrus, copper had negative impact on all insects



Copper's Impact on Beneficials



RAMP = with copper; comparison = without copper

Overall, no negative impacts of copper

THANK YOU!

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