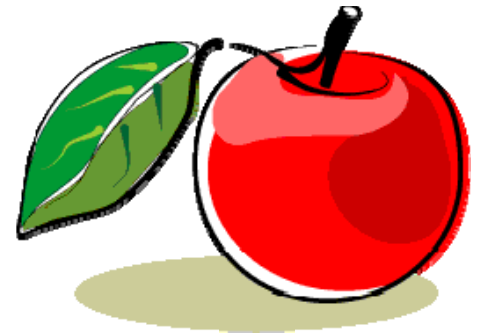
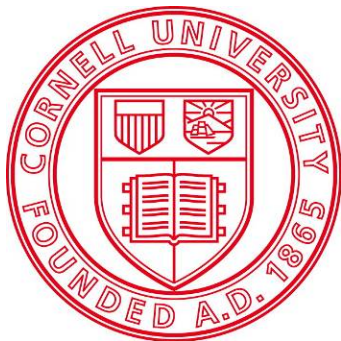


The use and fit of the new SDHI fungicides for apple disease management

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Outline

- New fungicides for apple scab & powdery mildew
 - Overview SDHI & SDHI premix fungicides
 - Field efficacy for apple scab & powdery mildew
 - Fungicide resistance and SDHI fungicides
- Apple scab & powdery mildew management considerations for 2015

Succinate dehydrogenase inhibitor (SDHI) fungicides

- FRAC Code: 7 Complex II succinate dehydrogenase
- Effective against Apple scab, Botrytis, Anthracnose, Sooty blotch, Fly speck, Powdery Mildew



Apple Scab

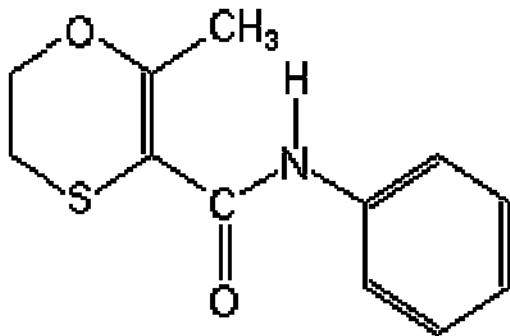


Bitter rot: Anthracnose

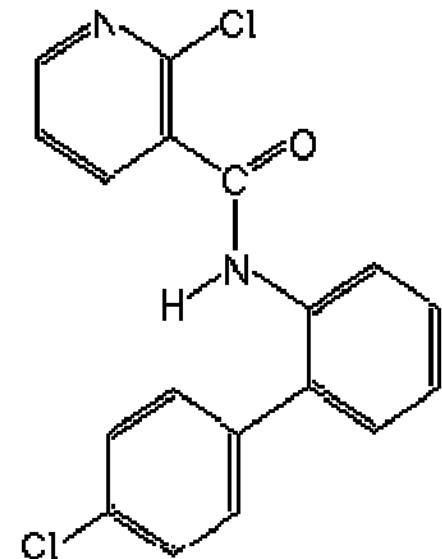
SDHI fungicides

- Interfere with respiration: ATP production
 - Inhibits spore germination, mycelial growth, & sporulation
- Older chemistries: oxathiin- carboxamides & pyridine- carboxamides

Carboxin
(Vitavax, Kisvax)



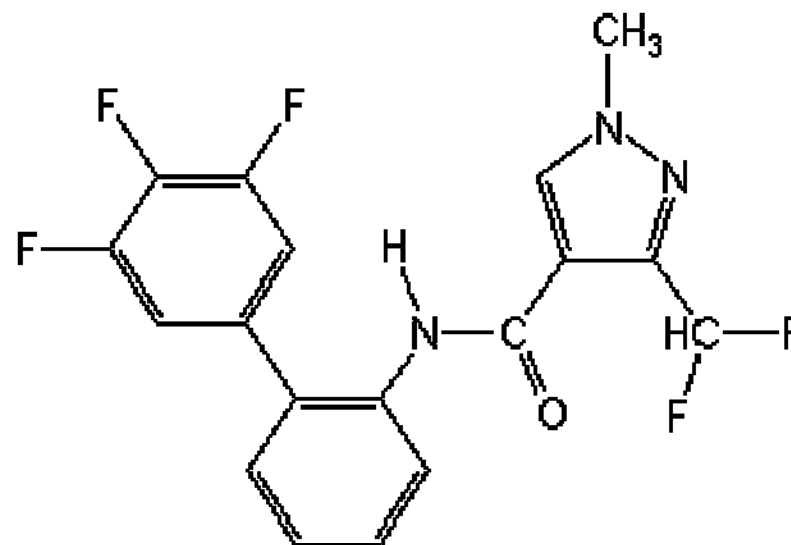
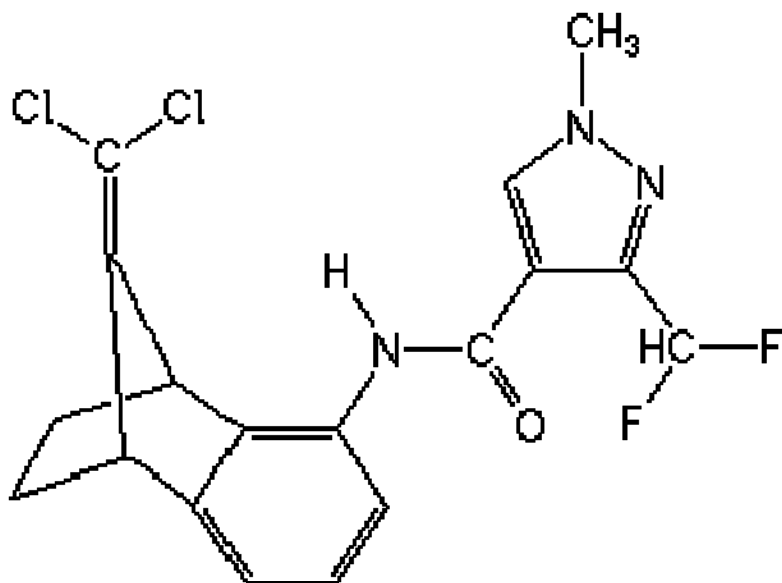
Boscalid



SDHI fungicides

- Newer SDHI chemistries:
 - Pyrazole-4-carboxamides: fluxapyroxad (**Xemium** - **Merivon**), penthiopyrad (**Fontellis**), and benzovindiflupyr (**Solatenol**)

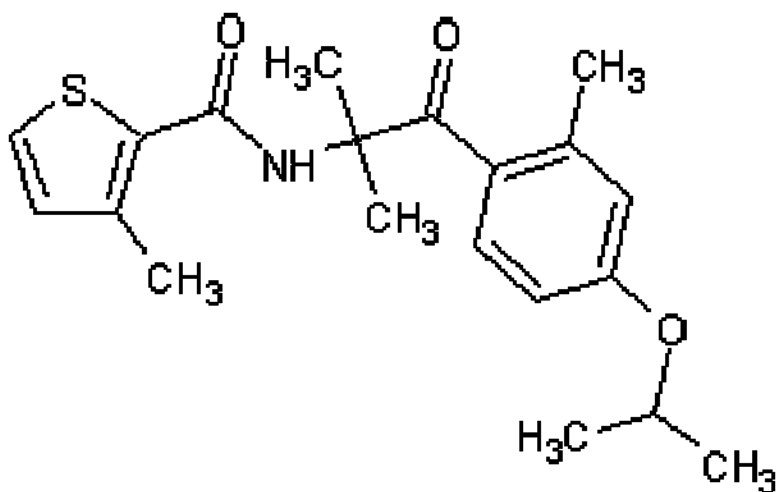
Pyrazole-4-carboxamides



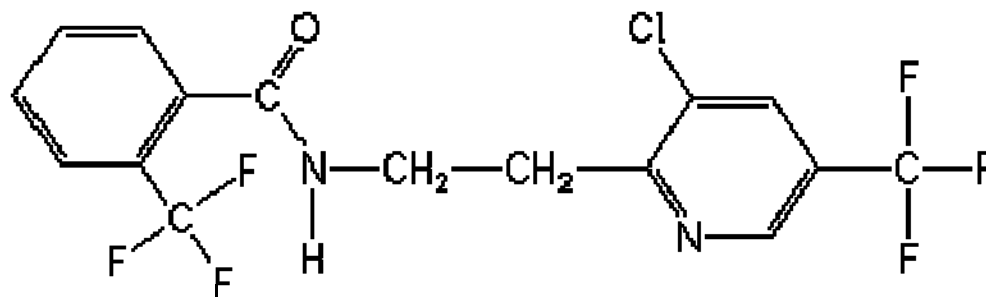
běn-zō-vīn-dī-floo-pīr

SDHI fungicides

- Newer SDHI chemistries:
 - Pyridinyl-ethyl-benzamides: fluopyram (**Luna**, Bayer CropScience)
 - Phenyl-oxo-ethyl thiophene amide: isofetamid (ISK biosciences)



phenyl-oxo-ethyl thiophene amide



Pyridinyl-ethyl-benzamides

SDHI fungicides

- Current and forthcoming SDHI products!
 - Luna (fluopyram): Bayer CropScience
 - Luna Sensation: SDHI + QoI (trifloxystrobin)
 - Luna Tranquility: SDHI + AP (pyramethanil)
 - Merivon (fluxapyroxad): BASF, SDHI + QoI (pyraclostrobin)
 - Fontellis (penthioopyrad): DuPont
 - (Isofetamid): ISK biosciences 201#?
 - Aprovia (Solatenol): Syngenta 2015/2016?

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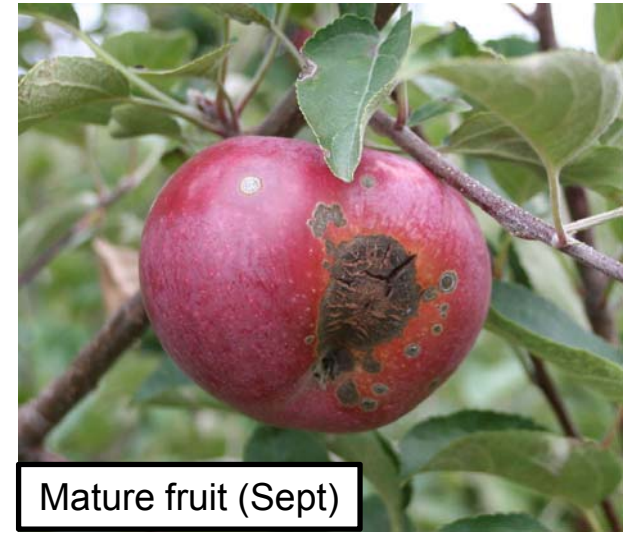
SDHI fungicide (field efficacy)

Geneva Field Trials

- Mature research orchard site (2012)
 - ‘Empire’ and ‘Jonagold’- M.9/M.111 interstem
- Apple scab population - practical resistance to DMI & QoI fungicides
- Fungicide treatments:
 - Application timed at 7-10 day intervals from TC - 2nd cover
 - Alternated with effective protectant standards ➔ not to exceed max applications (4 applications)

SDHI fungicide (field efficacy)

- Apple scab
 - Evaluate: Incidence any lesion on cluster leaves and fruit (June), terminal leaf scab (July), & **harvest mature fruit (Sept)**



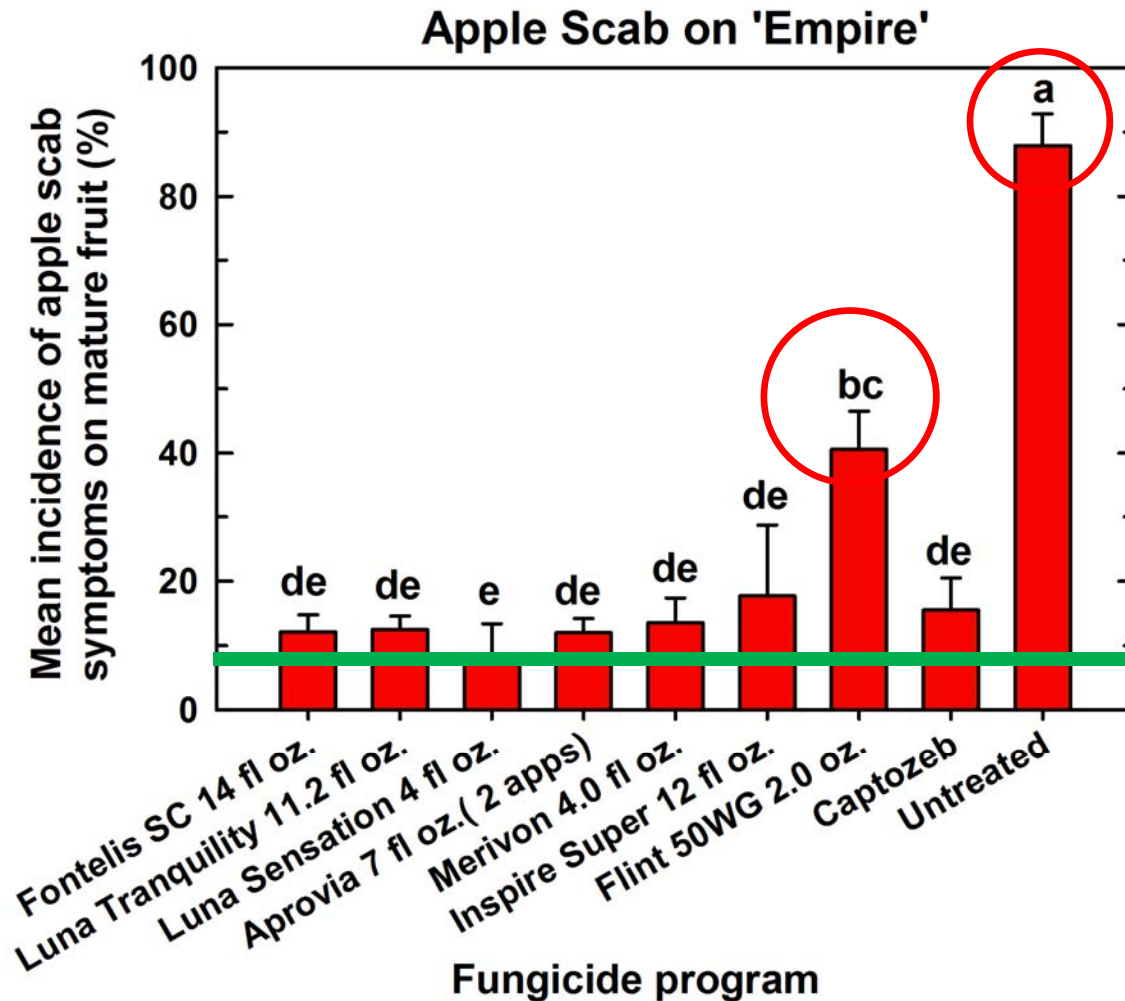
SDHI fungicide (field efficacy)

- Powdery mildew:



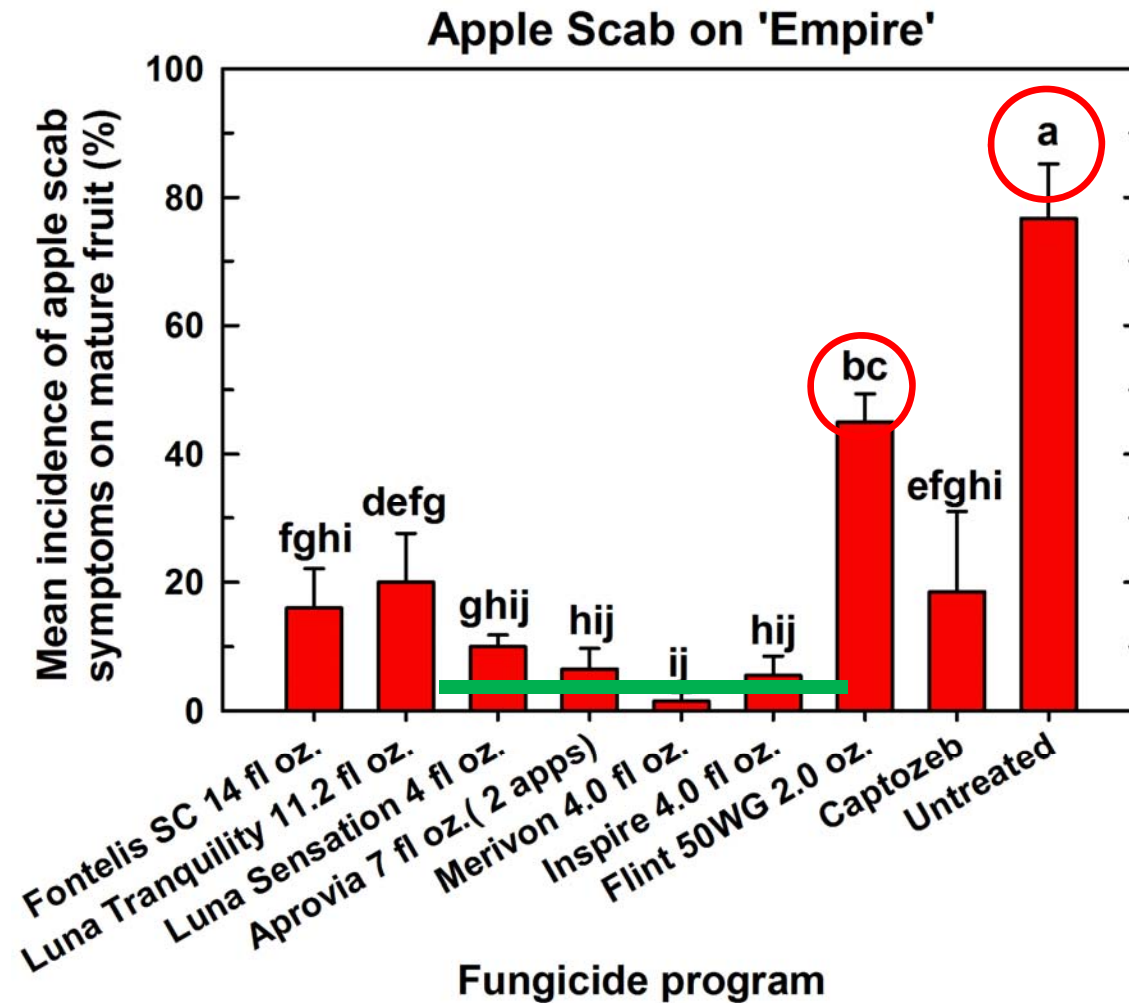
- Evaluate severity on terminal leaves (% leaf area)
- Severity → product differences only → commercial levels not so severe

Apple Scab Performance (2012)



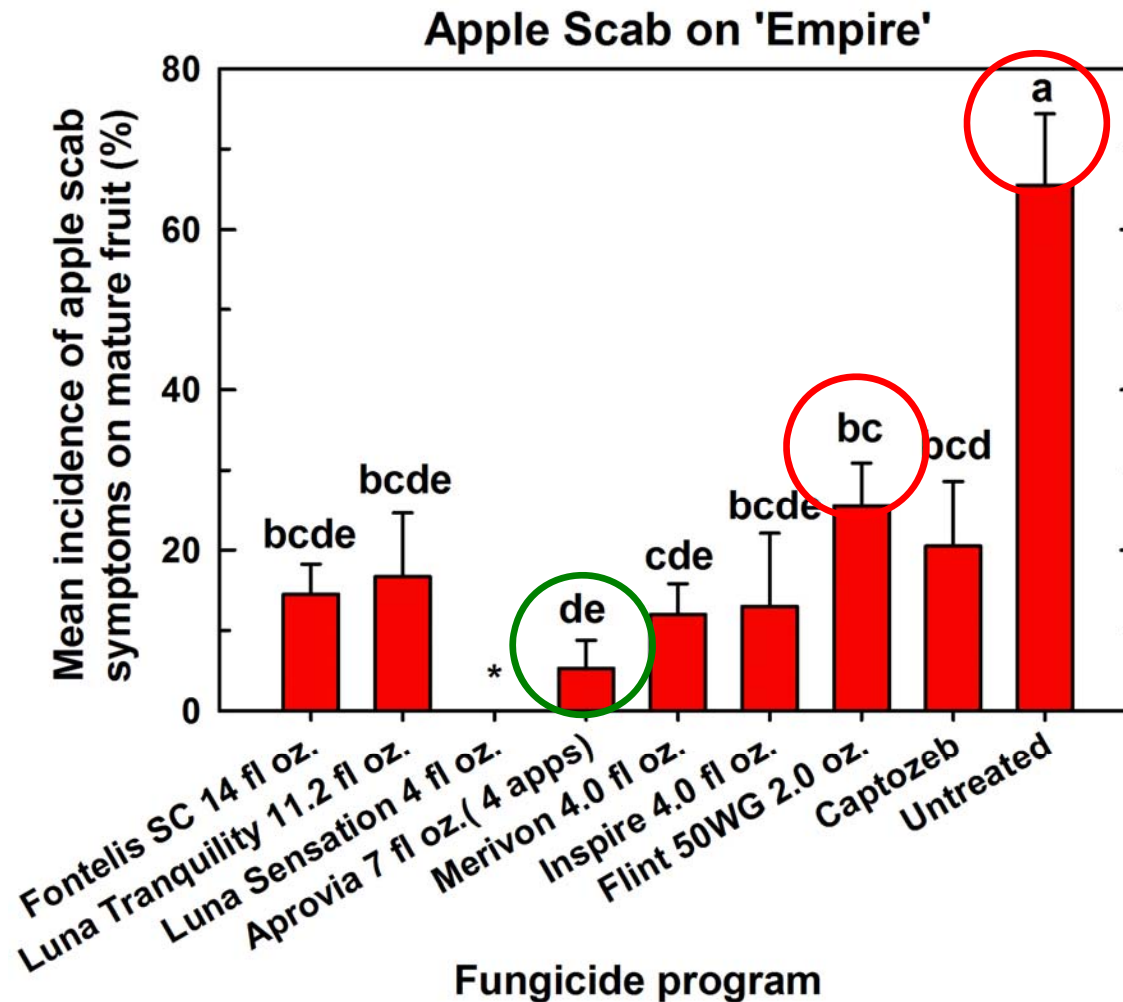
- SDHIs & QoI/SDHI premixes = high level of control
- Practical resistance to QoI fungicides apparent, but Luna Sensation and Merivon unaffected

Apple Scab Performance (2013)



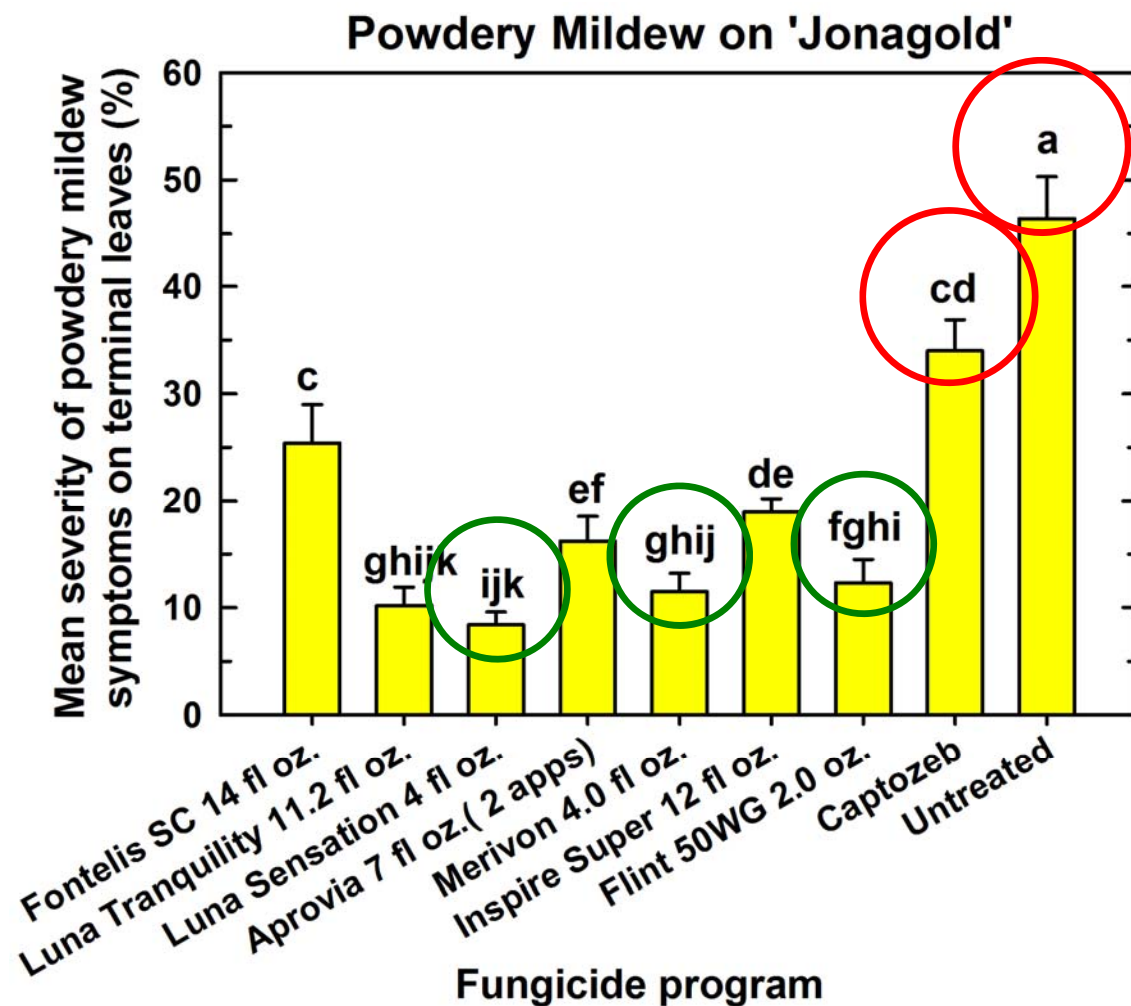
- QoI/SDHI premixes unaffected by QoI resistance & Aprovia provide most consistent control (std errors)

Apple Scab Performance (2014)



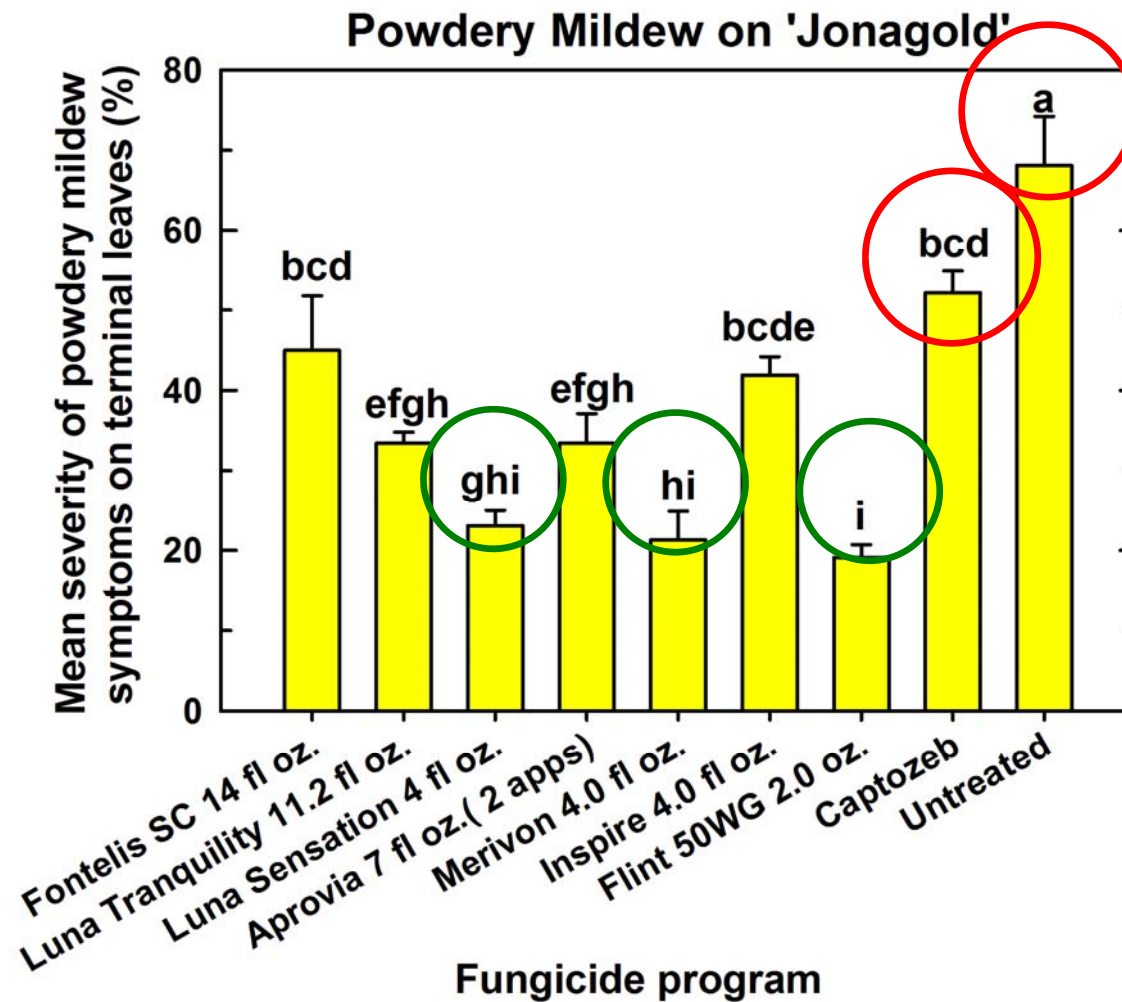
- QoI/SDHI(premixes) & Aprovia \geq than protectant Practical resistance to QoI fungicides barely apparent, but Merivon still unaffected

Powdery Mildew Performance (2012)



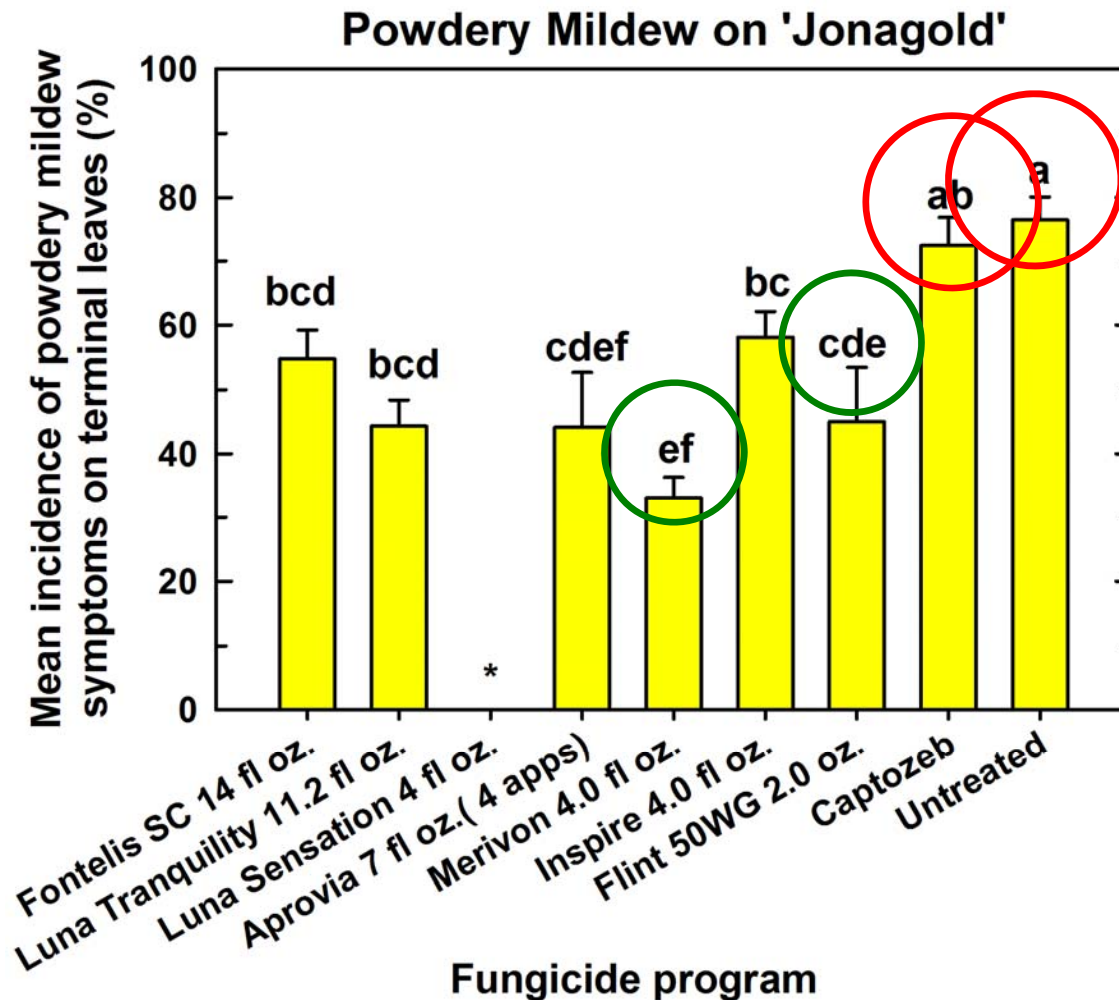
- Only QoI/SDHI premixes have slight advantage over SDHIs alone for mildew control

Powdery Mildew Performance (2013)



- Only QoI/SDHI premixes have slight advantage over SDHIs alone for mildew control

Powdery Mildew Performance (2014)



- Only QoI/SDHI premixes have slight advantage over SDHIs alone for mildew control

SDHI Fungicide Summary

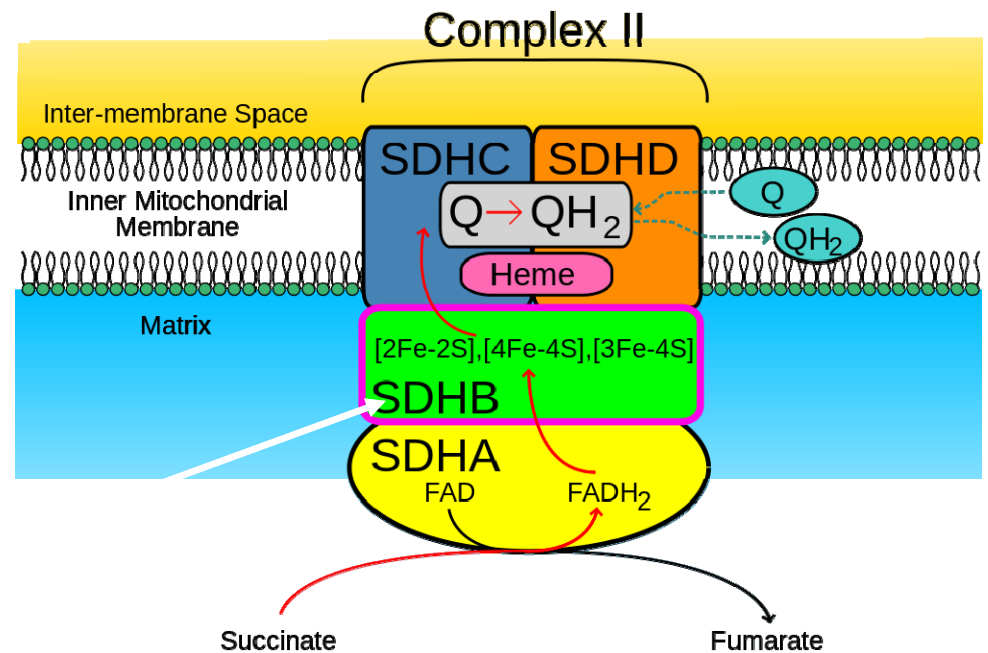
- SDHI fungicides & apple scab
 - SDHI fungicides alone (esp. Aprovia) advantage over protectants
 - QoI/SDHI premixes (Luna products & Merivon) & SDHI Aprovia have a slight advantage
- SDHI fungicides & powdery mildew
 - Standalone SDHI fungicides some effect against mildew
 - QoI/SDHI premixes SDHI premixes **stronger** against mildew

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What about SDHI resistance?

- SDHI fungicides: Bind to mitochondrial complex II subunit in ETC (respiration)
- Mechanisms of resistance:
 - Target site mutations in the *SDHB* gene (succinate dehydrogenase complex, subunit B, iron sulfur)



What about SDHI resistance?

- SDHI fungicide resistance in other systems (e.g. Botrytis): point mutations in SDHB gene
 - SDHB* gene of *V. inaequalis*



What about SDHI resistance?

- Where do we stand?
 - No isolates found to possess mutations in *SDHB* gene in *V. inaequalis*
 - Baseline testing of penthiopyrad in 2008-2009: NY and New England populations are effectively “baseline” to this chemistry (same as wild populations)
 - We are finishing some baseline testing of several SDHI fungicides and can see intrinsic differences

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Management Considerations

- Early season (ST to GT)
 - Copper 1lb. elemental copper per 100 gal/A trees. High MCE coppers typically have higher residual activity (Kocide, Badge, etc.)
- Early season (HIG to TC)
 - Consider Syllit (dodine) if we have a wet spring + 2 application max (no rust activity or post-bloom applications)

Management Considerations

- Early season (Hig to bloom)
 - Consider Fontelis or Luna Tranquility (cold spring) at this timing
- Mid season (PF to 1st cover)
 - Consider avoiding captan in large tanks mixes at thinning timings
 - Avoid wetting or oil-derived adjuvants, or fungicides with lots of mixing warnings
 - Try to obtain a premium captan (e.g. Captan Gold)

Management Considerations

- Mid season (PF to 1st cover) captan alternatives: use mancozeb or polyram +
 - Inspire Super (2 apps for summer) for apple scab
 - Luna Tranquility, **Flint**, or **Merivon** (2 apps for summer) for powdery mildew
 - High mildew pressure - need clean leaves?
 - Add low rate of sulfur (3lbs per 100g) as protectant to all applications, except during hot weather
 - Select Merivon or Pristine (**cost**) for your premium summer disease fungicide

Questions

