Tree Fruit Fungicides in Review

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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
SDHI fungicides

• Interfere with respiration: ATP production
  – Inhibits spore germination, mycelial growth, & sporulation

• Older chemistries: oxathiin- carboxamides & pyridine- carboxamides

[Chemical structures of Carboxin (Vitavax, Kisvax) and Boscalid]
SDHI fungicides

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

`bēn-zō-vǐn-dī-floo-pīr`

Pyrazole-4-carboxamides
SDHI fungicides

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

- Current and forthcoming SDHI products!
  - Luna (fluopyram): Bayer CropScience
    - Luna Sensation: SDHI + QoI (trfloxystrobin)
    - Luna Tranquility: SDHI + AP (pyramethanil) -24c
  - Merivon (fluxapyroxad): BASF, SDHI + QoI (pyraclostrobin) -24c
  - Fontellis (penthio.pyrad): DuPont -24c
  - 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 ≥ 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.
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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*

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5-44-11_contig  TCAACACTTTGGGCTTTGCCTGTTTGCCGTATTCCACGCCAGACGCACAAAGGGAAATCTCTCAGAATCTACCAACTACCGG
5-44-11_contig  CATAACCTACGTGGATTACCTGTGGAGACAATAGCTACAGATATGTACTTACTACAAAGCATAACCTGTAACCAACTGCTTGCGCTAACA
5-44-11_contig  ACCCTCAGCGCACAACGCCGGCCACACAGATTGAGCTCACCACCTGAAACTCATCTTAACACTGCTTCGCTAACA
5-44-11_contig  GGAAGAACACAGGGCCCTGAAACAGACATCCATTTGAAAGCCATAGCTCGATGGCCCTTTATGAAATGCTTT
5-44-11_contig  TCTGGCCTGCTGACATTCTTCTTGCGCTCTTGACTGGTGGAACAGCAAGATACCTCGTGCTCCAGCAGTCCTCC
5-44-11_contig  CTTCAATCCCTACCGCTGGATCGCTGGGCACACTCGAGAGCGAGACCCAGCAGACGGCAGAGCTCACATG
5-44-11_contig  CATGTCTTGGTACCAGATGCACACACGTCTCAACTGCTCT
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323-325 CCT = P (P225F)

338-340: AAC N (N230I)

464-466: CAC H (H272L/R/Y)
What about SDHI resistance?

• Where do we stand?
  – No isolates found to possess mutations in \textit{SDHB} gene in \textit{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 1 lb. 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