New Fungicides

NEW FUNGICIDES (new modes of action)

- Fludioxonil ("Scholar")
  - Registered in Australia and other countries.
  - 'reduced risk' fungicide (USA EPA)
  - Codex MRL 10ppm widely accepted
- Pyrimethanil ("Philabuster")
  - Registered Australia and other countries
  - 'reduced risk' fungicide (USA EPA)
  - Codex MRL 7ppm; Australia 10ppm; Japan unclear; Korea 1ppm
  - Sold as mixture with Imazalil (50:50)

Fludioxonil (FLU)

Schirra (Italy)

- Simulated shipping trials (3wks @ 1°C, 6wks @ 8°C, 2wks @ 20°C)
  - Response to heat (2.6-4x MRL @50°C)
  - Min 400ppm @ 20°C; 100ppm @ 50°C gives 'considerable' control
  - Resulted in ~0.8ppm FLU residue in fruit

  - Used 3 minute dips (not Australian standard application)
  - 400ppm FLU @ 20°C, 10% decay; 400ppm IMZ @ 20°C, ~3% decay
  - FLU and IMZ equivalent control at 50°C (~3% decay)
  - Testing of 'wild' mould strains indicated some natural resistance to FLU (recommended use in mixtures &/or heated)

Fludioxonil (FLU)

Zhang (Florida)

- Simulated drench (3 min dwell, 4 min drain)
  - 500-1200 ppm FLU similar to 1000ppm IMZ or TBZ (Stem-end rot)
  - FLU compatible with chlorine (controls stem-end rot)
- Non-recovery spray
  - 500-2000ppm FLU similar to 1000ppm IMZ or TBZ (Green mould)
  - 1000 ppm FLU controlled TBZ-resistant isolate of green mould

Fludioxonil (FLU)

Zhang (Florida)

- Sporulation control (1 min dip; green mould)
  - Poor control with 1000ppm FLU compared to 1000ppm IMZ
- Non-recovery spray
  - Used natural inoculation (15% decay)
  - 500-1500 ppm FLU reduced decay to 4-5%; 1000ppm IMZ to ~2%

Fludioxonil (FLU)

Cunningham (Australia)

- Simulated drench (30 sec dip with 600ppm FLU)
  - Good control of green & blue mould on lemons
  - Good control of resistant TBZ strain of green mould on lemons
  - No phytotoxic response on any fruit (1500ppm max rate)
  - 600-1200ppm FLU control of mould inferior to 500ppm IMZ and 1000ppm TBZ for oranges and mandarins
  - Improved control of TBZ resistant strains compared to TBZ, but inferior to IMZ
  - Recommended for use on lemons, but inferior control mould on oranges and mandarins by itself. Recommended with mixtures

Fludioxonil (FLU)

Kanetis & Adaskaveg (California)

- FLU and sanitisers (laboratory studies)
  - Adding 3% sodium bicarbonate increases FLU efficacy
  - Adding sodium bicarbonate improves control when treatment is delayed (effective 24hr after inoculation)
  - Sodium bicarbonate, chlorine and FLU stable and effective
- FLU and stone fruit
  - Good control of Rhyzopus in stone fruit using FLU

Pyrimethanil (PYR)

Smilanick (California)

- Simulated dip/drench (30 or 60 sec dip or drench)
  - 500 ppm PYR or higher gave good control (green mould)
  - Adding sodium carbonate improved PYR performance
  - IMZ-resistant isolate of green mould controlled by PYR
  - Heat improves effectiveness of PYR to control green mould
  - PYR treatment effective up to 24hrs after inoculation
  - PYR efficacy stable at pH 4-7

Pyrimethanil (PYR)

Smilanick (California)

- Chlorine incompatible with PYR
- 1000 & 2000ppm PYR in wax, only 65% control (green mould)
- Sporulation control requires >4ppm PYR; inferior to IMZ
- PYR has poor protectant properties; inoculation 24hrs after treatment not controlled. Again, inferior to IMZ
- Recommended to use mixture of IMZ and PYR

Pyrimethanil (PYR)

Kanetis & Adaskaveg (California)

- PYR and sanitisers (laboratory studies)
  - Adding 3% sodium bicarbonate increases PYR efficacy
  - PYR compatible with peroxyacetic acid (POA) (eg.Tsunami)

- PYR/FLU and resistance
  - Multiple resistance was not found during testing (isolates resistant to IMZ or TBZ were susceptible to the new fungicides).

Drench

- TBZ + chlorine
- TBZ + 3% SBC + chlorine (pH<9)
- IMZ + POA
- IMZ# + 3% SBC + POA (pH<9)
- FLU + 3% SBC + chlorine (pH<9)
  - Lemons ☑ >12 hrs delay?
  - Oranges ? Use as mixture with TBZ or IMZ

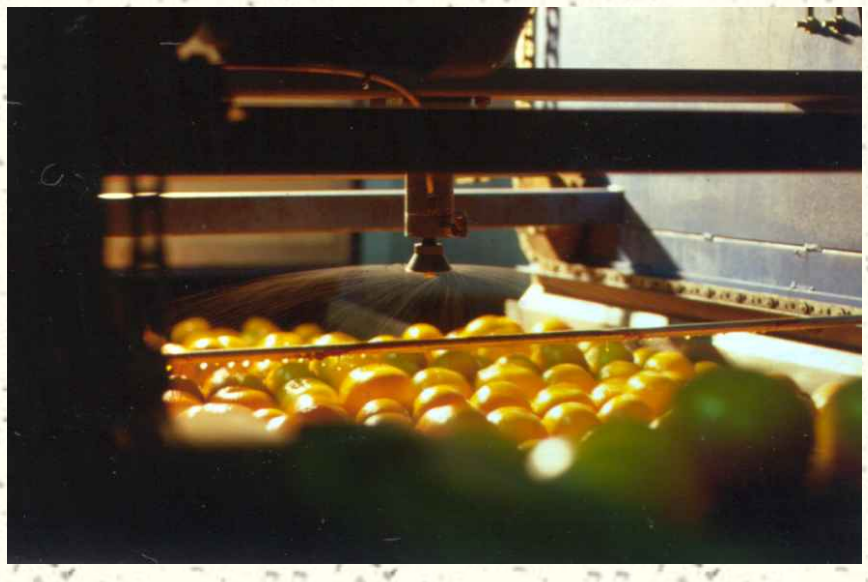
Imazalil sulphate precipitates out at pH<6 ; not recommended without strong agitation & watch MLRs

In-line fungicide

- TBZ + IMZ (with or without heat)
- TBZ + IMZ + 1% SBC
- IMZ + PYR (with or without heat)
- IMZ + PYR + 1% SBC + POA
- TBZ + FLU (with or without heat)
- TBZ + FLU + 1% SBC

In wax

- IMZ
- IMZ +PYR



INTEGRATE ROTATION & MIXTURES

Example only

Rotation over time

Drench	TBZ + 3% SBC + chlorine	TBZ+ FLU + 3% SBC + POA
In-line	IMZ + PYR (heated)	TBZ + FLU (heated)
In wax	IMZ + PYR	IMZ

Early season?
- Sour rot
- Degreening

Mid/late season ?
- Chilling injury
- IMZ MRL concern

SUMMARY

- Introduction of PYR & FLU is our opportunity resistance management by rotation of fungicides
- New fungicides should be mixed with other fungicides, sanitisers &/or heated to reduce the risk of resistance.
- The selection of fungicides should be based on integration across the packingline and over time.
  - Limit the fungicide groups in the packingline at any one time
  - Rotate or 'rest' various fungicide groups at different time

SUMMARY contd

- The selection of fungicides also needs to the consider market specifications and likely seasonal problems
  - Can use fungicide and SBC mixtures if sour rot prevalent
  - Can boost TBZ levels if chilling injury and reduce IMZ levels
- Need to integrate FLU & PYR into a resistance strategy
  - Match mixtures and rotations with current chemicals
- Need to develop strategies to effectively use FLU & PYR in the Australian context
  - Wider range of sanitisers to evaluate
  - How long should you rest and rotate fungicides?
  - Understanding decay control failure

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