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MEETING THE CHALLENGES IN POSTHARVEST DISEASE MANAGEMENT OF DECIDUOUS FRUIT

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POSTHARVEST DISEASES

- **Postharvest decay impacts significantly on quantity and quality of deciduous fruit crops produced in South Africa**
- **Some common diseases**
- **Grey mould**
- **Blue mould**
- **Brown rot**
- **Bull's eye rot**

INDUSTRY SUPPORT FOR POSTHARVEST RESEARCH

- **All the fruit commodity groups recognize the significance and impact of postharvest decay**
- **Managing postharvest decay has become a research priority**
- **Close association with growers, packhouses, and marketing specialists**
  - **Identify specific research needs,**
  - **Fund research through levies paid on exported fruit**
- **Postharvest decay research projects:**
  - **Identification and taxonomy of postharvest pathogens**
  - **Trials on correct application of current fungicides**
  - **Fungicide sensitivity monitoring in key target pathogens to these fungicides (FRAC and anti-resistance strategies) (Alternatives)**
  - **New and emerging postharvest diseases**

MANAGEMENT OF POSTHARVEST DISEASES

Integrated disease management using as many strategies as possible

- **Management of postharvest diseases begins in the orchard**
  - **All management strategies to reduce the primary inoculum**
- **Bloom applications to reduce blossom infection by *Botrytis* and *Monilinia***
- **Fungicide applications shortly before harvest to reduce contamination on fruit (residue present/persistent during harvest)**
- **Reduce latent infections (Bull's eye rot, Brown rot)**
- **Fungicide application after harvest (protect fruit during storage)**
- **Management of the cold chain at the appropriate temperature is key to managing postharvest decay**

CHALLENGE

Restrictions on use of organic chemicals/fungicides postharvest

- **Dependance on organic chemicals to manage postharvest decay pathogens**
- **Use of these chemicals in the postharvest treatment of fruit, has become more restricted**
- **Withdrawal of chemical because of potential impacts on human health and environmental concerns**
- **Countries set their own MRLs to limit these risks for acceptable chemistries**
- **Rigorous registration process before being sold**
- **Many markets limit the number of actives permitted, say to three actives (including all actives, of both pre and postharvest chemical application which may be present on packed fruit)**
- **Some markets demand that fruit they are willing to buy has lower than the set MRL for certain actives. This has implications for effective disease management and fungicide resistance risk**

CHALLENGE

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Dependance on Fludioxonil

- **Few fungicides available to manage postharvest decay pathogens on fruit**
- **Fludioxonil is the single most important, and widely used postharvest fungicide (apple and pear; and stone fruit industries)**
- **Dependance of these industries on this single chemical, and its widespread use**
- **Significant risk of target pathogens developing resistance to the chemical (Taiwo, *et al*., 2021)**
- **Greater risk currently is the threat of losing the active for some important markets (Brandhorst and Klein, 2019)**

FRAC ANTI-RESISTANCE STRATEGY

Fludioxonil and pyrimethanil/International markets

Both registered on apples and pears for control of *Penicillium* sp., and *Botrytis* sp.

Fludioxonil: FRAC GROUP 9

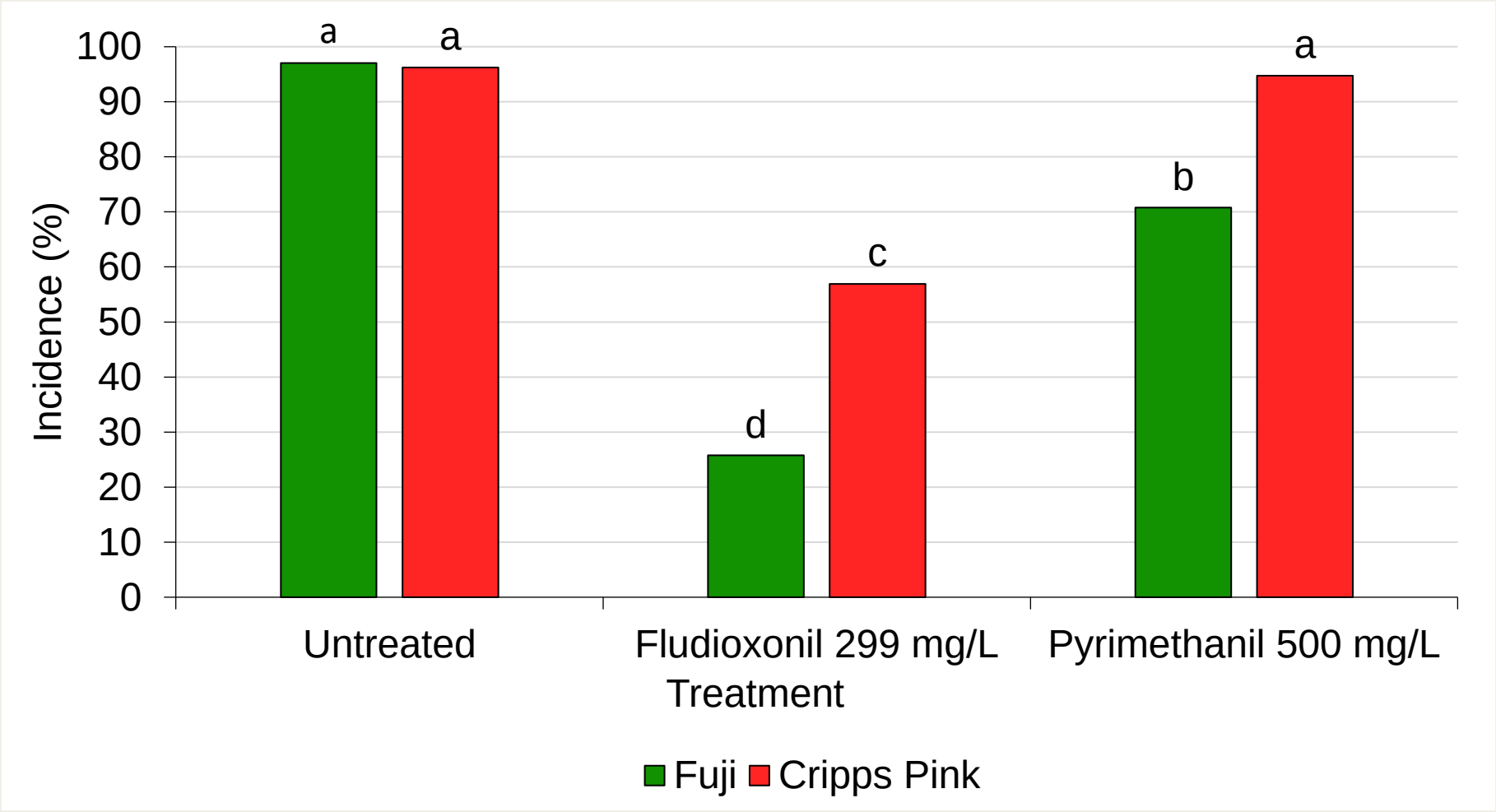
Pyrimethanil: FRAC GROUP 12

Rotation of these two fungicides between seasons will slow down the resistance shift

Sanitation of bins, cold rooms and packlines

BULL'S EYE ROT MANAGEMENT

Fungicides applied as a postharvest curative drench at recommended concentrations



Residue
FLU: 2.5 mg/kg
PYR: 0.04 mg/kg

MRL (EU)
FLU: 5 mg/kg
PYR: 15 mg/kg

BULL'S EYE ROT MANAGEMENT

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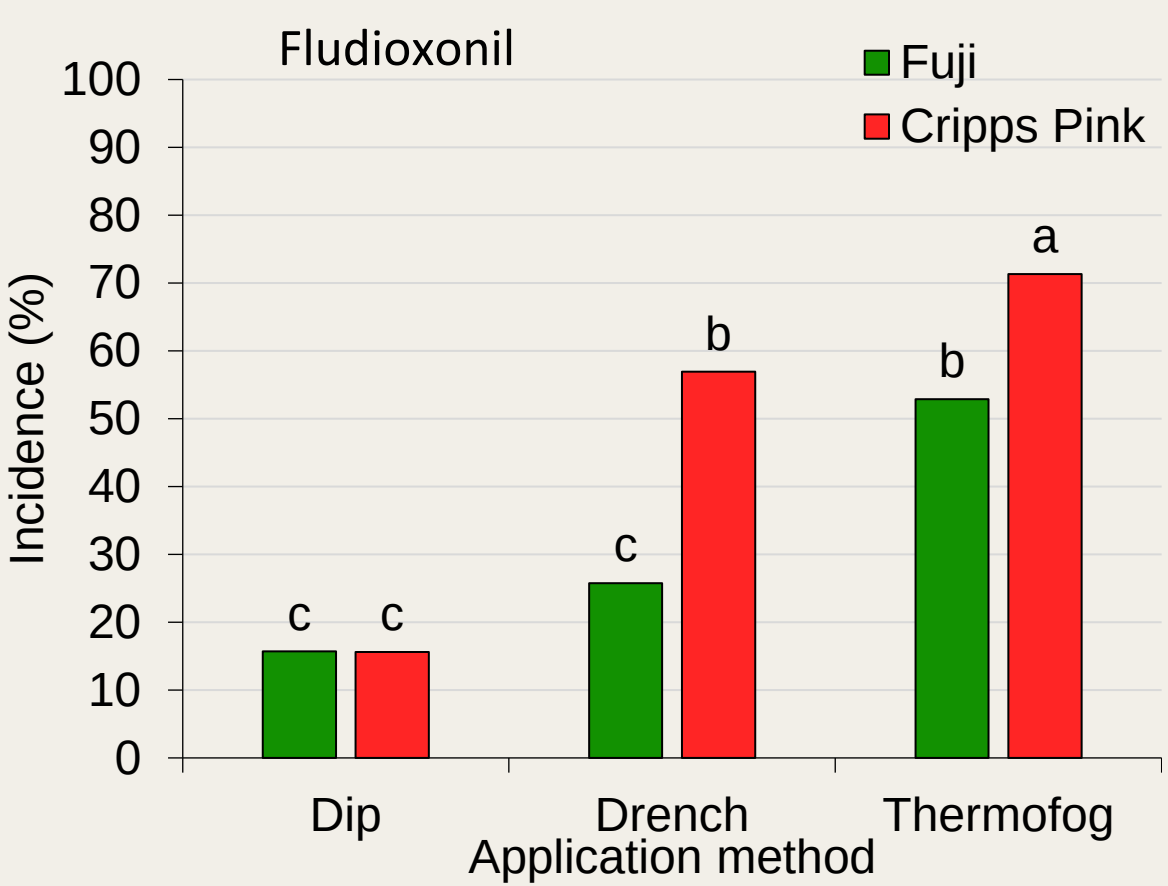
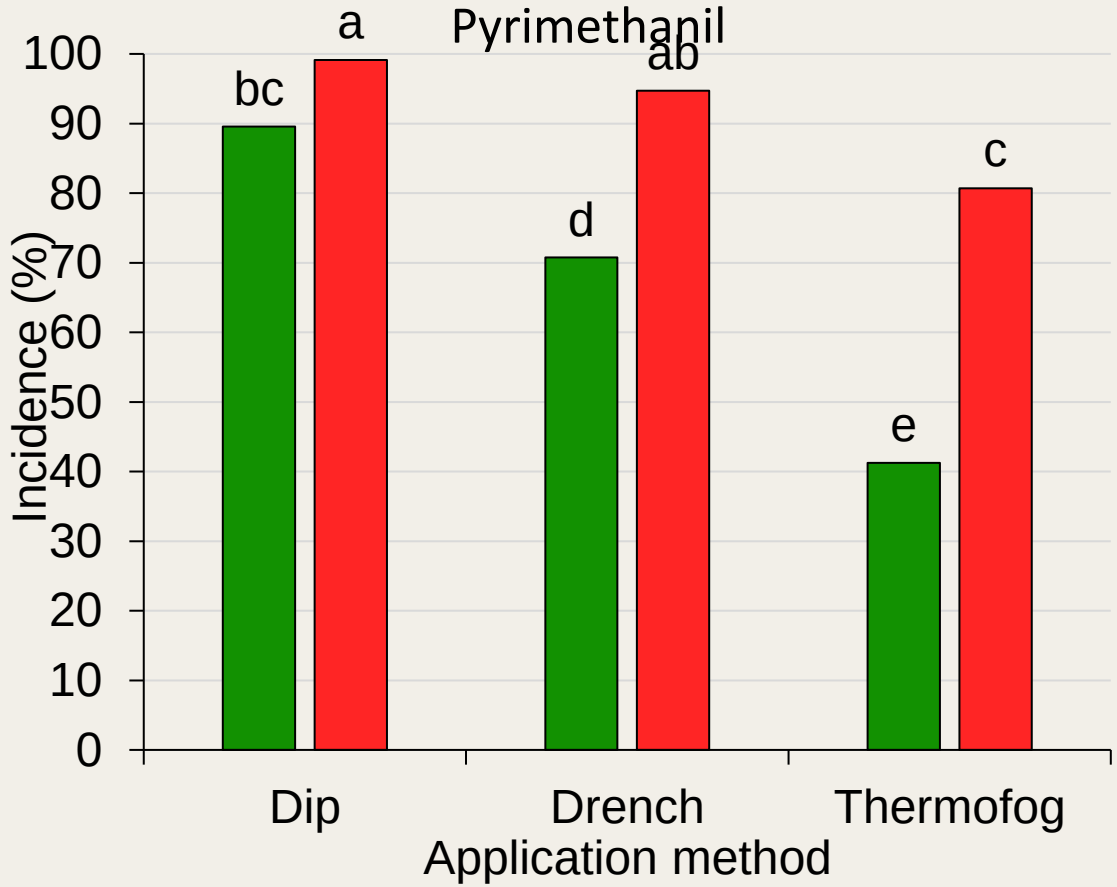
Fungicides applied as curative postharvest treatments at recommended concentrations





ALTERNATIVES TO FUNGICIDES

Reduce our reliance on organic fungicides

- **These alternatives include GRAS products, essential oils, and biologicals**
- **Wenneker and Thomma (2020) review of alternatives to chemical fungicides for controlling postharvest diseases**
- **Most of the alternatives do not offer adequate control as stand-alone treatments**
- **More effective as part of an integrated disease management strategy**
- **Research into alternatives is vital for sustainable/long term management of postharvest diseases**

RESEARCH CASE STUDY

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Study to investigate the efficacy of CLPs from *B.amyloliquefaciens* in managing postharvest Grey mould of pears

Bacillus amyloliqufaciens **(bacterium)**

Produces secondary metabolites

- **Cyclolipopeptides (CLPs): Iturin A and Fengycin**
- **Strong antifungal activity**

CLP from Process Engineering (SU)

Carriers of the CLP

- **Zein edible coating : Protein based coating produced from maize to increase shelf life**
- **Carnauba wax : Natural plant wax made from Brazilian palm leaves to minimise water loss**

Comparative treatments to determine efficacy

- **Serenade ASO ®- preharvest biofungicide containing living bacterial cells and secondary metabolites from *Bacillus subtilis***
- **Fludioxonil**

RESEARCH CASE STUDY

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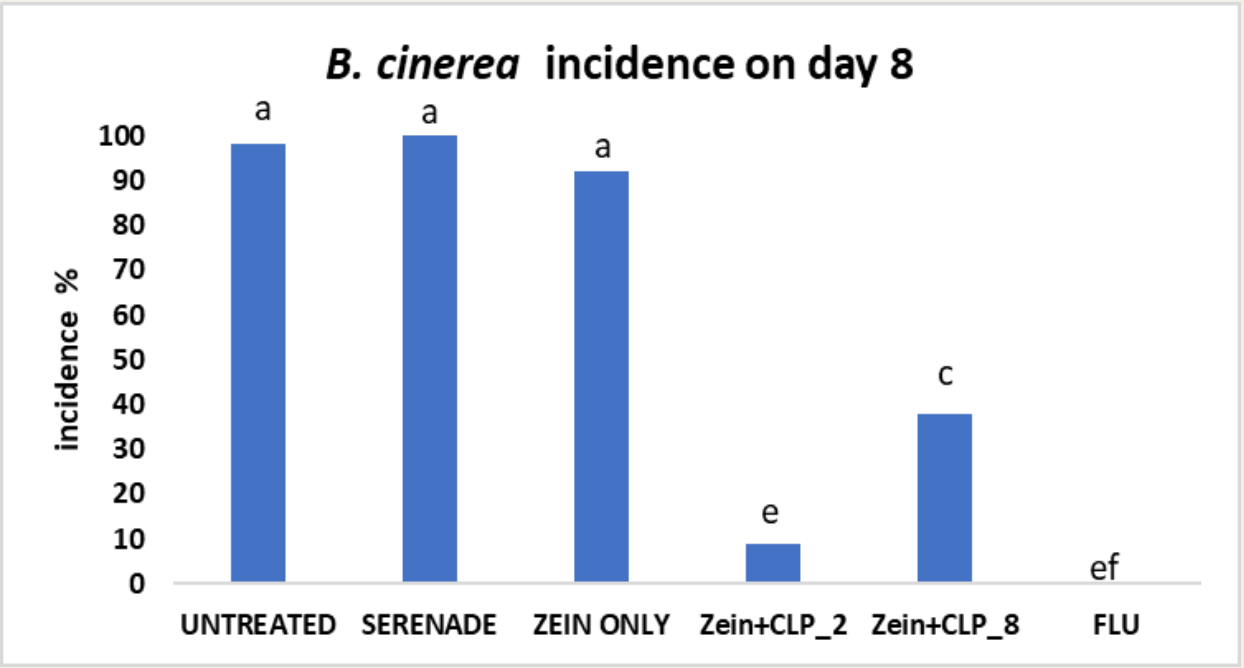
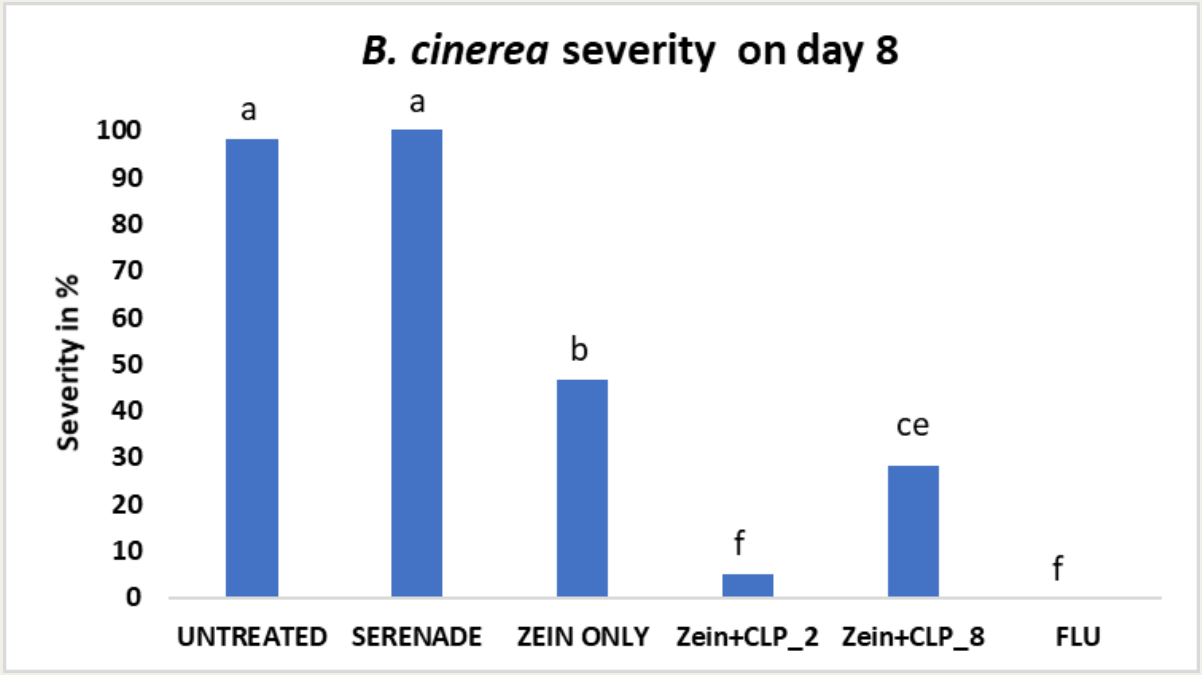
Alternatives to organic chemicals/fungicides/pears/curative





NEW CHALLENGE

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Stem and calyx sepal mould

Superficial mould restricted to the fruit pedicles (stems) and calyx sepals on apples and pears coming out of Controlled Atmosphere Storage

Seen on long-term stored fruit before packaging and shipping

Export destinations have reported these moulds

Major cost implications to exporters

‘Cosmetic mould’ (Sosa et al., 2016)

Reported in countries such as Argentina and USA

***Alternaria* spp. and *Cladosporium* spp. were identified as causal fungi**

WHICH FUNGI CAUSE THIS MOULD ON SA FRUIT AND HOW CAN WE MANAGE IT?

NEW CHALLENGE

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Stem and calyx sepal mould research results

Main morphological groups : *Alternaria*, *Cladosporium* and *Eppicoccum* spp. (cf. Sosa *et al.* 2016; Lutz *et al.*, 2017)

Inoculum present in orchard and proliferate under favourable conditions (moisture levels)

Epiphytic/Endophytic and pathogenicity being investigated

Efficacy of postharvest fungicides, fludioxonil and pyrimethanil in managing this mould

Alternatives to Fludioxonil and Pyrimethanil

CONCLUSIONS

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Postharvest pathogens and the South African Fruit Industry

- **Despite the many challenges faced by the South African fruit industry, sound research and investment from commodity groups and plant protection industries have afforded the fruit industry many opportunities to meet these challenges**
- **Lessons learned from research done on the major fruit commodities like citrus and deciduous fruit need to be filtered down to the minor crops**
- **The authors would like thank the South African Fruit Industry for their support for research on postharvest disease management**

HORTGRO science
Growing Fruit IQ

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