



Improving management of white mold in dry beans: Optimizing fungicide timing in pinto beans

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Optimizing fungicide application timing

Research question tested in these studies:

when should fungicides be applied

**when soil moisture and canopy wetness are high-risk
for white mold as dry beans enter bloom?**

If conditions do not favor white mold as dry beans enter bloom, applications should be delayed until weather becomes favorable for white mold.

Improving white mold management in dry beans: Fungicide application timing – methods

Row spacing = 14 inches in most studies; 28 inches in some studies

Seeding rate = 90,000 viable seeds/ac

Fungicide spray volume = 15 gal/ac.

Fungicide application method: Fungicides applied with a hand-held boom pressurized by CO₂ (2020, 2021, 2022) and with a PTO-driven tractor-mounted sprayer (2024).

Fungicide spray droplet size: medium in study conducted in 2017; fine, medium or coarse, calibrated relative to canopy characteristics, in 2020-2024.

Interval between sequential applications: 8 to 14 days, depending on study

Number of experimental replicates = 6, 7, 9, 10, 15 or 16, depending on study

White mold assessment: Assessed at or near dry bean maturity by evaluating every plant individually in minimum half of the rows per plot for percent of the plant impacted by white mold.

Harvest: To ensure that variability in dry bean standability (lodging) across the study did not bias yields, plants were clipped at base concurrent with disease assessments, wind-rowed to dry, and manually lifted into the combine.

Supplemental irrigation: Supplemental overhead irrigation was applied as needed to establish the white mold disease pressure needed to evaluate fungicide performance.

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Optimizing fungicide application timing: **pinto beans**

(1) Pinto beans with an open canopy:

Average canopy closure < 95% at 70-85% plants with initial pods

**Combined analysis
across 5 studies**

Carrington (2021)
cv. 'Palomino'
Topsin 40 fl oz f.b. Endura 8 oz

Oakes (2021)
cv. 'Palomino'
Topsin 40 fl oz f.b. Endura 8 oz

Carrington (2020)
cv. 'Lariat'
Topsin 30 fl oz f.b. Endura 8 oz

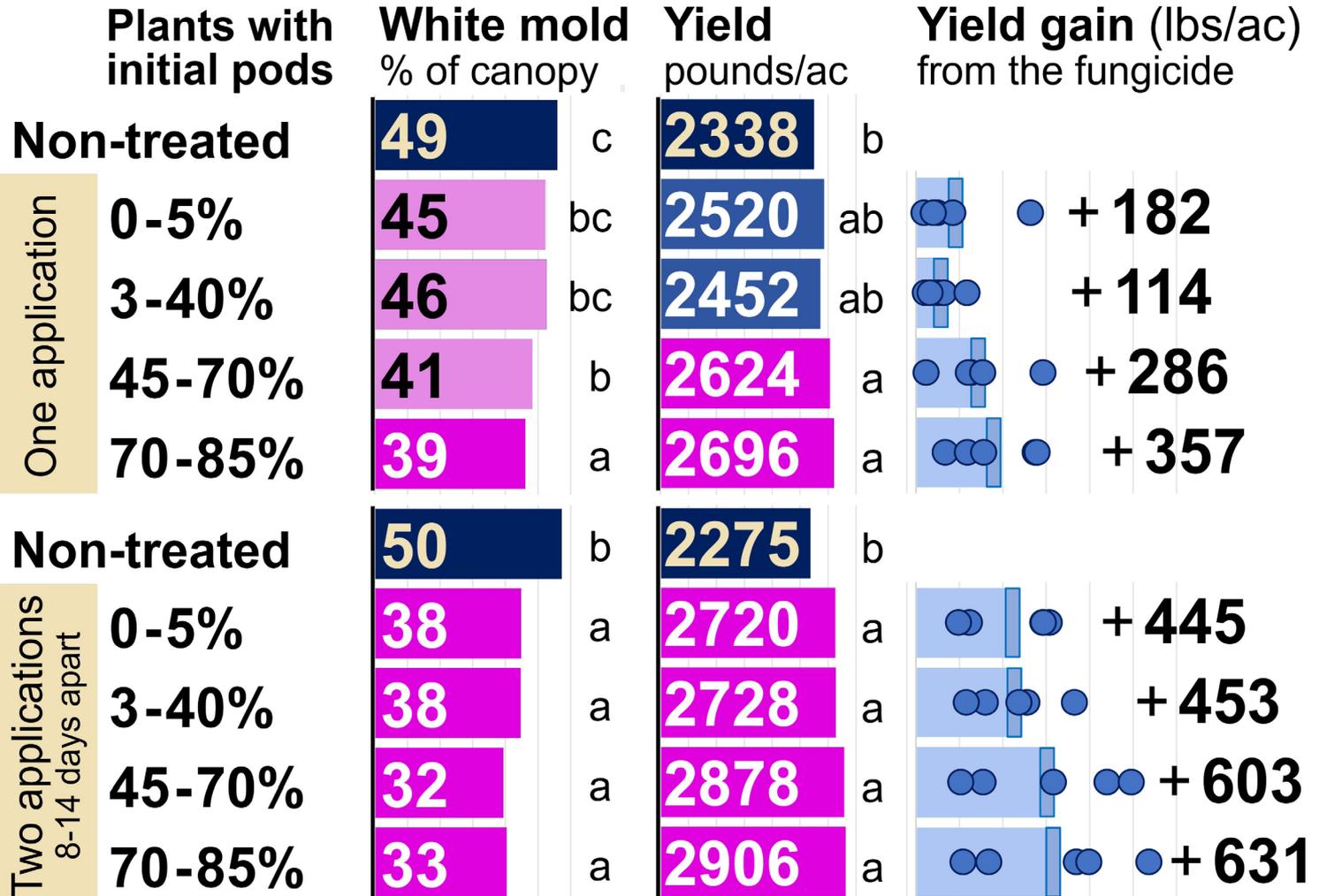
Carrington (2022)
cv. 'Palomino'
Topsin 40 fl oz f.b. Endura 8 oz

Carrington (2024)
cv. 'Torreon'
Endura 8 oz f.b. Endura 8 oz

Row spacing = 14".
Seeding rate = 90,000 viable
seeds/ac.

Spray droplet size calibrated
relative to canopy closure.
Spray volume = 15 gal/ac.

Within-column means followed
by different letters are
significantly different ($P < 0.05$;
Tukey procedure).

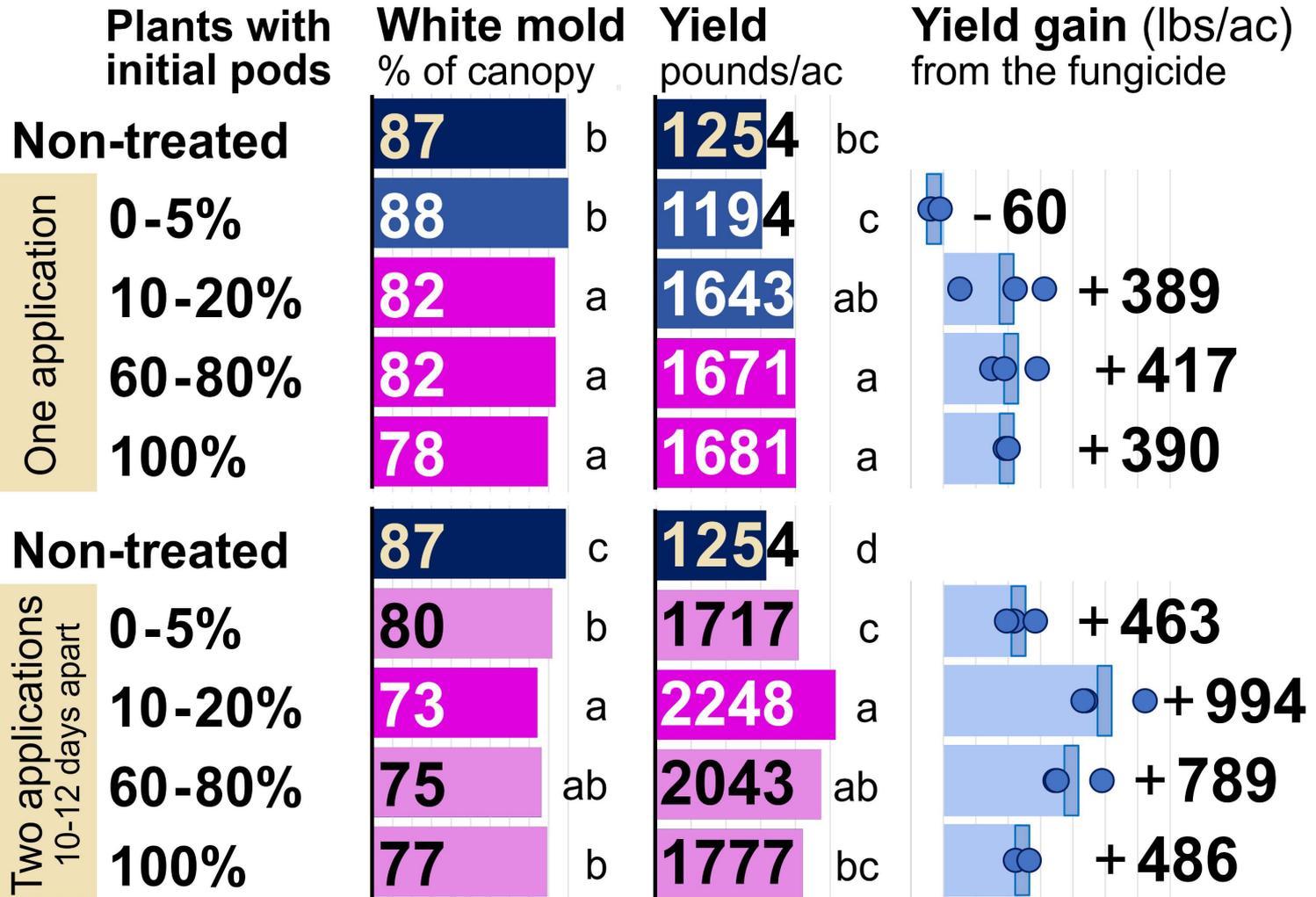


Optimizing fungicide application timing: **pinto beans**

(2) Pinto beans with a closed canopy:

Average canopy closure > 95% at 10-20% plants with initial pods

Combined analysis
across 3 studies



Carrington (2017)
cv. 'La Paz'
Row spacing = 14".
Topsin 30 fl oz f.b. Endura 8 oz

Oakes (2017)
cv. 'LaPaz'
Row spacing = 28".
Topsin 30 fl oz f.b. Endura 8 oz

Carrington (2022)
cv. 'Lariat'
Row spacing = 14".
Topsin 40 fl oz f.b. Endura 8 oz

Seeding rate = 90,000 viable seeds/ac.

Spray droplet size calibrated relative to canopy closure.
Spray volume = 15 gal/ac.

Within-column means followed by different letters are significantly different ($P < 0.05$; Tukey procedure).

Optimizing fungicide application timing: pinto beans

(1) Single fungicide application – pinto beans

fungicide efficacy was optimized when applications were made when **60-80% of plants had initial pods** irrespective of canopy closure.

(2) Two fungicide application sequence – pinto beans

fungicide efficacy was optimized when the first application was made when approx. **50-80% of plants had initial pods** (when the canopy was open) or **10-20% of plants had initial pods** (when canopy was at or near closure when 10-20% of plants had initial pods).

Improving crop disease management:

Fungicide application timing – fundamental concepts

Penalty to applying too late:

Fungicide applications must be made prior to pathogen infection.

- You cannot eradicate existing disease.
- Some, but not all, modern fungicides exhibit some degree of curative activity, but this curative activity is limited to the first few hours after pathogen infection – when pathogen infection can be seen only with a microscope and before disease lesions are present.

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Penalty to applying too early:

New growth is not protected by the fungicide.

- Only the biomass that exists at the time that the fungicide is applied is protected.
- This is a problem for white mold management because dry beans exhibit significant growth during early bloom.
- Dry beans increase in susceptibility to white mold as the percent of plants with initial pods (= % of plants with dead blossoms) increases

Improving crop disease management:

Fungicide application timing – fundamental concepts

New growth is not protected by the fungicide.

- Example from field peas
- These peas were treated with a fungicide at bloom initiation
- Growth that occurred after bloom initiation was unprotected and became diseased with powdery mildew.
 - This is why (in the picture at the right) the upper ~ 1/5 of the canopy is diseased and the lower ~ 4/5 of the canopy is healthy.



Optimizing fungicide application timing

CHALLENGES:

- White mold management not very good even at optimal application timing.
 - Disease rarely reduced by even 50%
- Applying at the perfect timing is very difficult
 - Dry bean growth & development is variable within most fields
 - Not every day is a suitable day for spraying

Optimizing fungicide application timing

Can we improve fungicide performance by modifying application interval and/or application frequency?

- Reducing the application interval reduces the amount of unprotected new dry bean growth and should reduce the penalty to applying fungicides applying too early
- ... but may require a third fungicide application under high disease pressure



People

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