



## 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

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**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 CO<sub>2</sub> (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

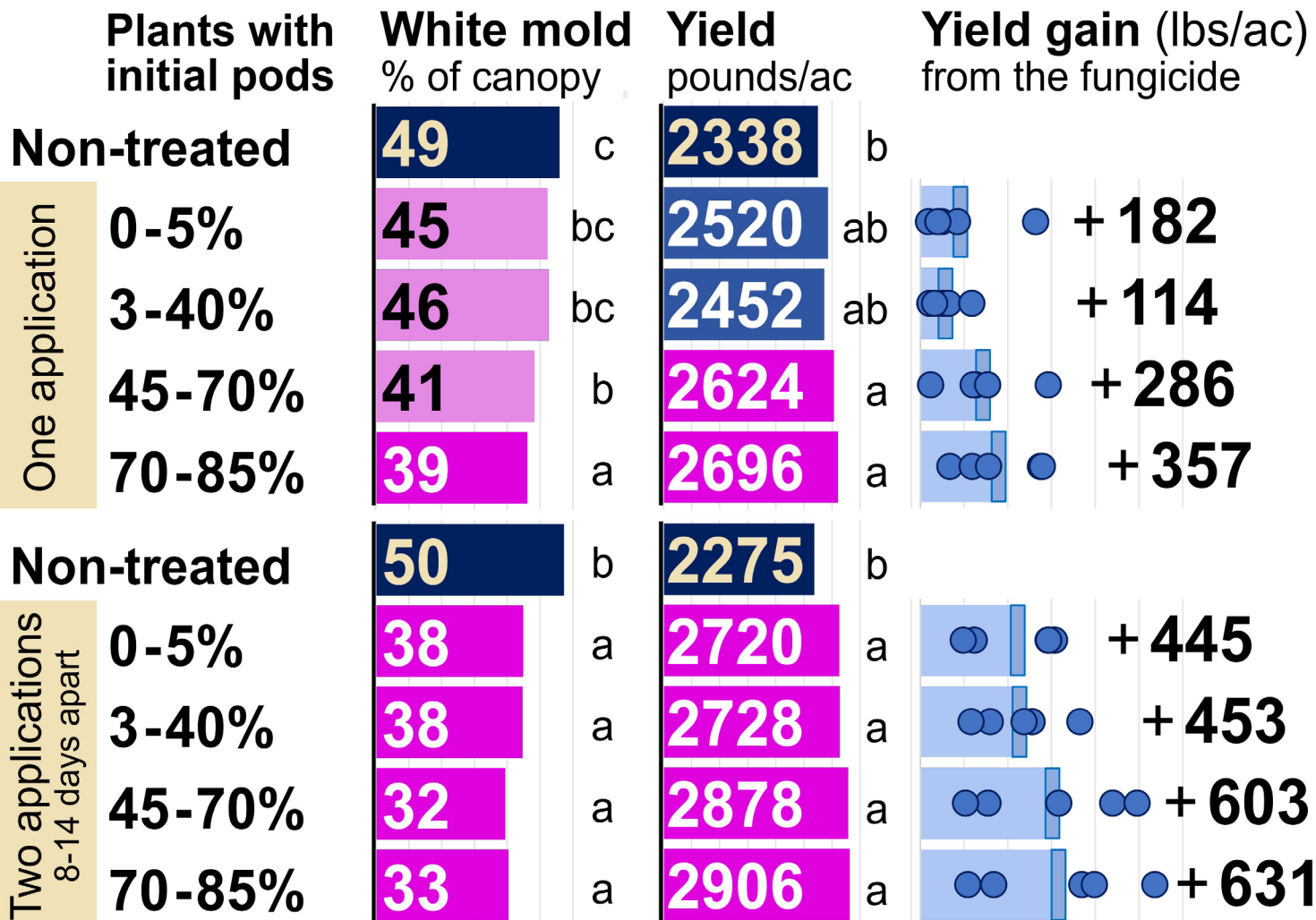
Carrington (2022)  
cv. 'Palomino'  
Topsin 40 fl oz f.b. Endura 8 oz

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).

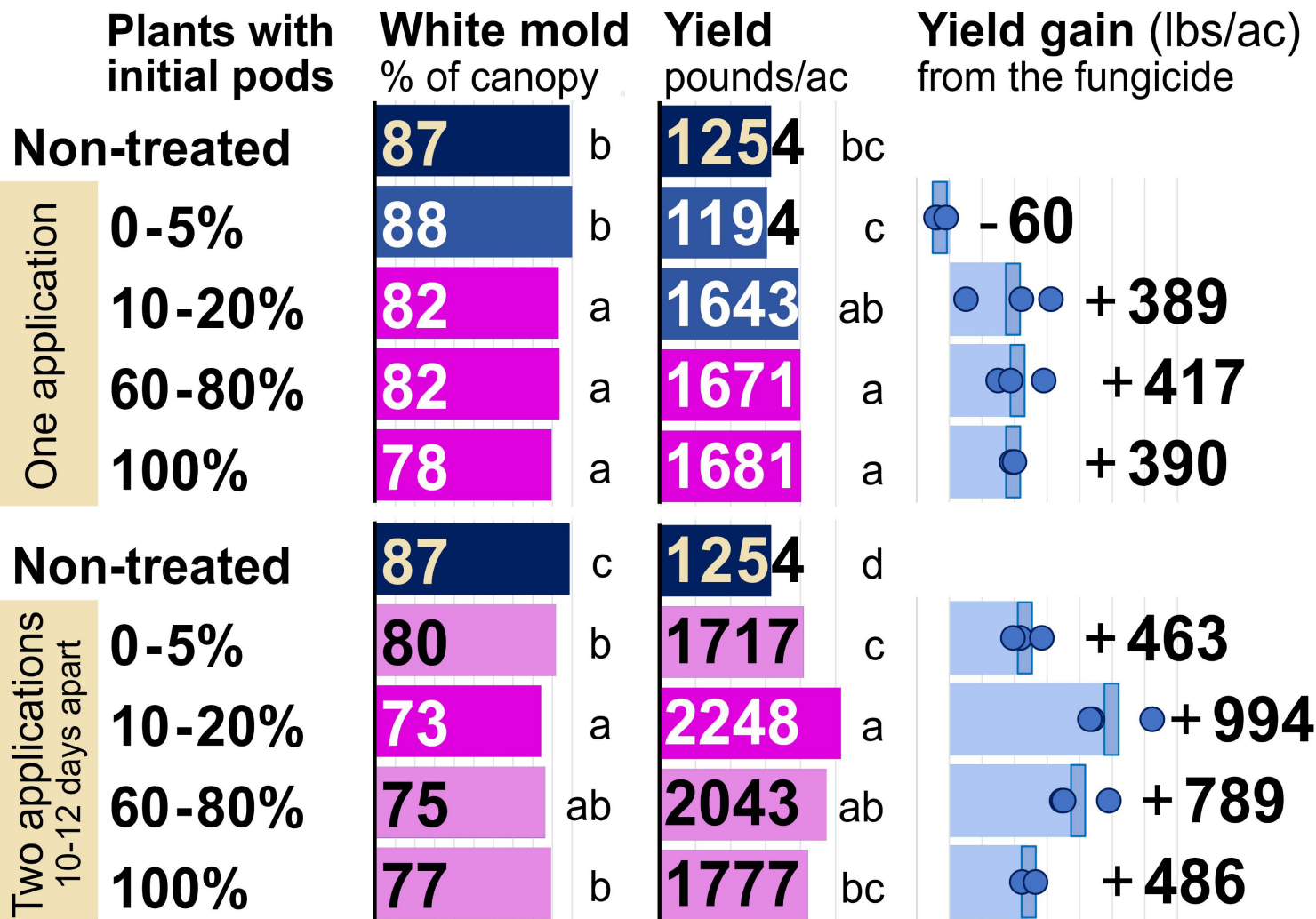


# Optimizing fungicide application timing: **pinto beans**

## (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).

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.

## Fungicide application timing – fundamental concepts

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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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Collaborators – Oakes: Heidi Eslinger, Spencer Eslinger, Leonard Besemann, Kelly Cooper





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