



Improving management of white mold in dry beans: Optimizing **fungicide timing** in navy 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 = 100,000 or 110,000 viable seeds/ac

Fungicide spray volume = 15 gal/ac.

Fungicides applied with a hand-held boom pressurized by CO₂.

Fungicide spray droplet size: medium in study conducted in 2017; fine, medium or coarse, calibrated relative to canopy characteristics, in 2020-2022.

Interval between sequential applications: 10 to 14 days, depending on study

Number of experimental replicates = 6, 10 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: **navy beans**

(1) **Navy beans:** studies where canopy was open and daytime high temperatures in mid-upper 80s, low 90s (84-92°F) at initial pod

NAVY

warm temperatures

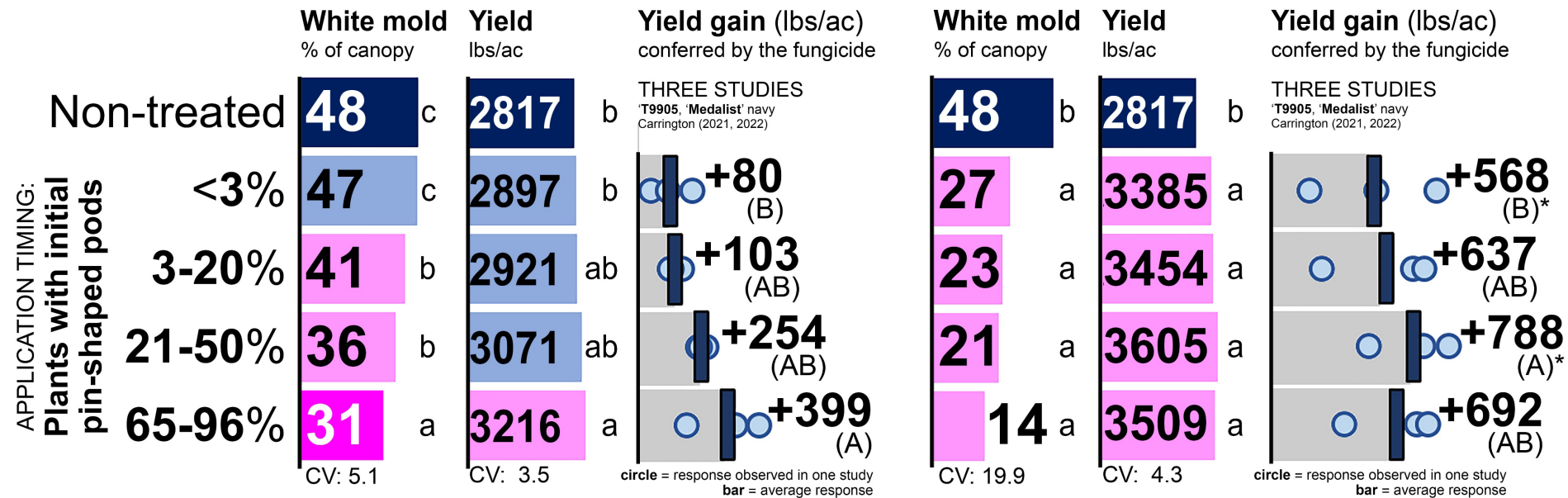
<95% canopy closure when 21-50% of plants had initial pods

average daily high observed between 2nd and 3rd application timing: **88-90°F**

average daily high observed between 3rd and 4th application timing: **84-92°F**

(A) SINGLE FUNGICIDE APPLICATION

(B) TWO APPLICATIONS, 10-14 days apart



'T9905' and 'Medalist' navy beans Carrington, ND (2021, 2022)

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

Topsin (40 fl oz) or Topsin (40 fl oz) followed by Endura (8 oz) 10 or 14 days later

Row spacing = 14" Spray volume = 15 gal/ac.

Optimizing fungicide application timing: **navy beans**

(1) **Navy beans:** studies where canopy was open and daytime high temperatures in low 80s (79-82°F) at initial pod

NAVY
cool temperatures

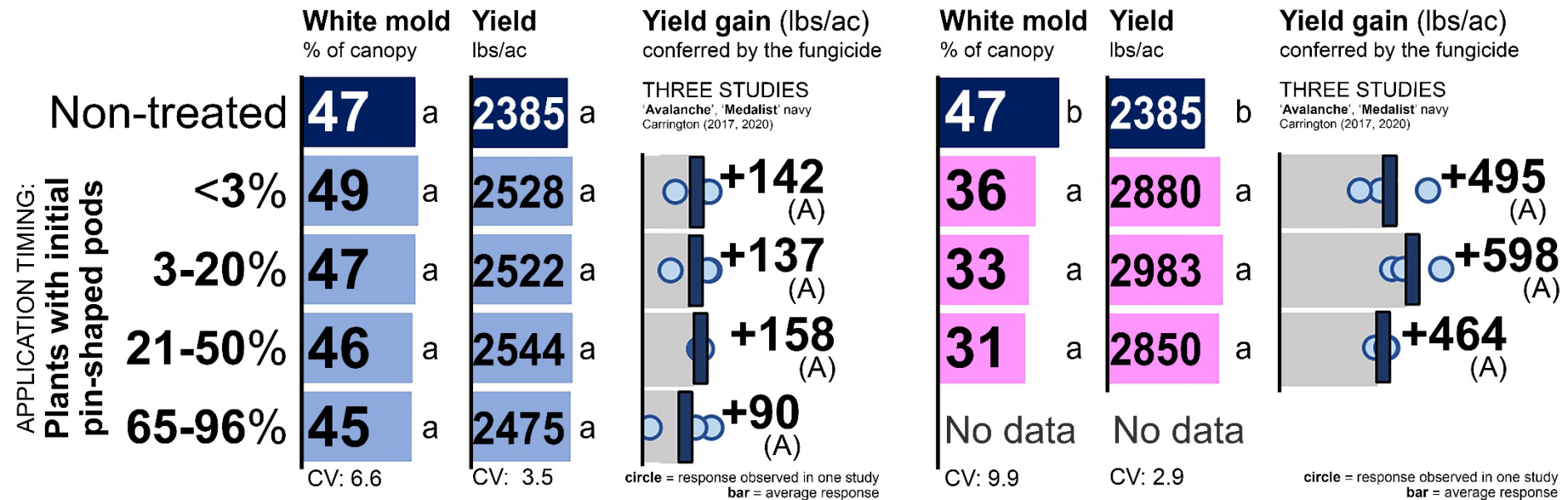
<95% canopy closure when 21-50% of plants had initial pods

average daily high observed between 2nd and 3rd application timing: **79-80°F**

average daily high observed between 3rd and 4th application timing: **80-82°F**

(A) SINGLE FUNGICIDE APPLICATION

(B) TWO APPLICATIONS, 10-14 days apart



'Avalanche' and 'Medalist' navy beans Carrington, ND (2017, 2020)

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

Topsin (30 fl oz) or Topsin (30 fl oz) followed by Endura (8 oz) 10-12 days later

Row spacing = 14" or 28". Spray volume = 15 gal/ac.

Optimizing fungicide application timing: **navy beans**

(1) Single fungicide application – navy beans

Optimal application timing was **65-95% of plants with initial pods** when temperatures were high at initial pod (mid to upper 80s°F).

When temperatures in low 80s°F at initial pod, a single fungicide application provided unsatisfactory white mold management.

(2) Two fungicide application sequence – navy beans

Optimal application timing was **3-20% of plants with initial pods** when conditions were cool at initial pod (low 80s°F) and **20-50% of plants with initial pods** when temperatures were high (mid 80s to low 90s°F) at initial pod.

The canopy was open in all of the studies in which application timing was tested (<95% closure through 50% of plants with 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

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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