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Field evaluation of fungicides for management of rust on dry edible (pinto) beans

Carrington, ND (2013) ▪ 14-inch row spacing

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KEY FINDINGS:

- **Aproach** (6.0 fl oz/ac) **and Aproach Prima** (5.0 and 6.8 fl oz/ac) **provided excellent control of rust in this trial.**
- **A single fungicide application** (conducted at the R3 growth stage when rust was at trace levels except for one "hot spot" of severe disease) **was sufficient to provide excellent control of rust; a second application 13 days later** (at the R5 growth stage) **did not improve disease control.**

	Treatment (application timing) [u]	Rust severity: Top of canopy [y ‡] Aug. 26 [v] % of leaf area	Rust severity: Bottom of canopy [x] Aug. 26 [v] % of leaf area	Yield: 13.5% moisture lbs/ac	Test weight: 13.5% moisture lbs/bu
1	**Non-treated check** (water; **A**)	**1.89** b*	**2.8** b*	**1342** c*	**60.6** a*
2	**Aproach 250SC** 6 fl oz/ac + **NIS** 0.25% v/v **(A)**	**0.13** a	**0.4** a	**1775** ab	**60.5** a
3	**Aproach Prima 280SC** 5 fl oz/ac + **NIS** 0.25% v/v **(A)**	**0.08** a	**0.3** a	**1628** bc	**60.2** a
4	**Aproach Prima 280SC** 6.8 fl oz/ac + **NIS** 0.25% v/v **(A)**	**0.05** a	**0.3** a	**1741** ab	**60.2** a
5	**Aproach Prima 280SC** 6.8 fl oz/ac + **NIS** 0.25% v/v **(A,B)**	**0.00** a	**0.3** a	**1550** bc	**60.3** a
6	**Aproach 250SC** 6 fl oz/ac + **Asana XL 80EC** 9.6 fl oz/ac + **NIS** 0.25% v/v **(A)**	**0.06** a	**0.5** a	**1785** ab	**60.2** a
7	**Aproach Prima 280SC** 6.8 fl oz/ac + **Asana XL 80EC** 9.6 fl oz/ac + **NIS** 0.25% v/v **(A)**	**0.08** a	**0.4** a	**1578** bc	**60.6** a
8	**Aproach 250SC** 6 fl oz/ac + **Prevathon 50SC** 14 fl oz/ac + **NIS** 0.25% v/v **(A)**	**0.13** a	**0.6** a	**1549** bc	**60.3** a
9	**Aproach Prima 280SC** 6.8 fl oz/ac + **Prevathon 50SC** 14 fl oz/ac + **NIS** 0.25% v/v **(A)**	**0.06** a	**0.4** a	**1724** ab	**60.3** a
10	**Quilt Xcel** 14 fl oz/ac + **NIS** 0.25% v/v **(A)**	**0.05** a	**0.9** ab	**1954** a	**60.5** a
	F:	9.2	3.87	2.30	0.90
	F > *P*:	< 0.0001	0.0030	0.0457	0.5371
	CV:	120.5	66.0	13.5	0.6

[y] **Percent of the leaf area covered by rust pustules, top third of the canopy.**

[x] **Percent of the leaf area covered by rust pustules, bottom third of the canopy.**

[v] **On August 26**, the pinto beans were at late pod-fill (late R6 growth stage).

[u] **Application timing:**

Application A: August 1 at 5:20 to 6:00 pm; R3 growth stage (several pods at full length on each plant), no rust present, approx. 2% of the canopy collapsed due to Sclerotinia stem rot; 77 to 79˚F, wind = 2.4 to 4.1 mph out of the northeast, 36 to 37% relative humidity

Application B: August 14 at 11:40 am; late R5 growth stage; rust at moderate to severe levels on the west end of trial (adjacent to plots 110, 210, 310 and 410) but at zero to low levels elsewhere, approx. 60% of the canopy collapsed due to Sclerotinia stem rot; 78.5˚F, 34.7% relative humidity, 2.2 to 4.5 mph wind out of the southeast

* **Within-column means followed by different letters are significantly different** ($P < 0.05$; Fisher's protected least significant difference).

‡ In order to meet meet model assumptions of normality and homoskedasticity, a systematic natural-log transformation [LN(x + 1) for data sets with one or more values less than 1, otherwise LN(x)] to the raw data used for statistical analysis. For ease of interpretation, treatment means are reported as the (untransformed) values.

Active ingredients in fungicides evaluated:
Aproach = 250 grams picoxystrobin per liter
Aproach Prima = 200 grams picoxystrobin + 80 grams cyproconazole per liter
Quilt Xcel = 140 grams azoxystrobin + 120 grams propiconazole per liter

Active ingredients in insecticides evaluated:
Asana XL = 80 grams esfenvalerate per liter
Prevathon = 50 grams chlorantraniliprole per liter

Aproach Prima and Quilt Xcel are not currently registered for use on dry beans and should not be used.
Results for these products are provided for reference only.

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METHODS:

- **Location of trial:** NDSU Carrington Research Extension Center, Carrington, ND.
  GPS coordinates of research trial location: 47.5122, -99.1240
- **Tillage:** Disked in October 2012 and cultivated twice, once deep (mid-May 2013) and once shallow (on May 29).
- **Fertility:** 98 lbs/ac nitrogen, 6 ppm phosphorous, 131 ppm potassium, pH = 7.9, organic matter = 3.3%, 0.35 mmho/cm soluble salts at 0 to 6 inches depth, 0.32 mmho/cm soluble salts at 6 to 24 inches depth. Supplemental nitrogen was added as urea (46-0-0) in early May; to each acre, 100 lbs of urea (46 lbs of nitrogen) were applied.
- **Maintenance herbicide applications:** Sonalan HFP (ethalfluralin; Dow AgroSciences) was applied at 2 pts/ac in 10 gallons of water/ac at 10:00 am on May 29. It was manually incorporated to approx. 1.5 inches with a shallow cultivation on May 29.
- **Variety:** 'Othello' (pinto bean)
- **Experimental design:** randomized complete block **Replicates:** 4
- **Seeded plot size:** 5 ft (center-to-center) x 25 ft long **Harvested plot size:** 5 ft (center-to-center) x approx. 19 ft long
- **Untreated buffer plots were established between treatment plots.**
- **Row spacing:** 14 inches **Rows per plot:** 4
- **Previous crop:** spring wheat
- **Planting date:** May 29, 2013
- **Seeding rate:** 91,950 pure live seeds/ac (target plant population = 80,000 plants/ac; presumed seedling mortality = 13%)
- **Application A:** August 1 at 5:20 to 6:00 pm; R3 growth stage (several pods at full length on each plant), no rust present, approx. 2% of the canopy collapsed due to Sclerotinia stem rot; 77 to 79˚F, wind = 2.4 to 4.1 mph out of the northeast, 36 to 37% relative humidity
- **Application B:** August 14 at 11:40 am; late R5 growth stage; rust at moderate to severe levels on the west end of trial (adjacent to plots 110, 210, 310 and 410) but at zero to low levels elsewhere; 78.5˚F, 34.7% relative humidity, 2.2 to 4.5 mph wind out of the southeast
- **Application details:** Fungicides were applied with a 56-inch hand boom equipped with four equally spaced Spraying Systems TeeJet XR 8001VS flat-fan nozzles at a spray volume of 15 gal water/A operated at 35 psi.
- **Disease establishment:** Dry bean residues from pinto beans that had a severe rust epidemic in 2012 were placed into the external guard plots on June 13 shortly after emergence. The dry beans were at VC growth stage (unifoliate leaves unfolded). The residues were collected in October 2012 prior to disking and overwintered on the soil surface. Sam Markell's team inoculated the trial with greenhouse-produced rust spores on Monday, July 22. To facilitate disease development, overhead irrigation was applied to this trial with a pivot.
- **Rust severity assessment:** The percent of the leaf area covered by rust pustules was assessed in the top third and bottom third of the canopy on August 26 at the late R6 growth stage (lot pod-fill).
- **Harvest date:** The dry beans were pulled (uprooted) at maturity on September 19 and harvested on September 26. Yields were suppressed due to Sclerotinia stem rot; fungicides were applied targeting rust, not Sclerotinia, and the application timing was too late for Sclerotinia control.
- **Statistical analysis:** Data were evaluated with analysis of variance. Seed moisture levels were assessed during grain processing after harvest, and seed yield and quality results were adjusted to 13% grain moisture. (1) The assumption of constant variance was assessed with Levene's test for homogeneity of variances and visually confirmed by plotting residuals against predicted values. (2) The assumption of normality was assessed the Shapiro-Wilk test and visually confirmed with a normal probability plot. (3) The assumption of additivity of main-factor effects across replicates (no replicate-by-treatment interaction) was evaluated with Tukey's test for nonadditivity. To meet model assumptions, a systematic natural-log transformation [LN(x+1) for data sets with values less than 1, otherwise LN(x)] was applied to the rust data. Single-degree-of-freedom contrasts were performed for all pairwise comparisons of isolates; to control the Type I error rate at the level of the experiment, the Tukey multiple comparison procedure was employed. For reference, Fisher's protected least significant difference was also calculated; note that Fisher's protected LSD does not control the Type I error rate for all pair-wise comparisons of treatments at the level of the experiment. Analyses were conducted with replicate and treatment as main factor effects, and they were implemented in PROC UNIVARIATE and PROC GLM of SAS (version 9.3; SAS Institute, Cary, NC).

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IMPORTANT NOTICE:

- Fungicide performance can differ in response to which diseases are present, levels of disease when products are applied, environmental conditions, plant architecture and the susceptibility to disease of the variety planted, crop growth stage at the time of fungicide application, and other factors.
- This report summarizes fungicide performance as tested at the NDSU Carrington Research Extension Center under the conditions partially summarized in this report.
- Fungicide efficacy may differ under other conditions; when choosing fungicides, always evaluate results from multiple trials.
- This report is shared for educational purposes and is not an endorsement of any specific products.