

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

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

Michael Wunsch, plant pathologist

Michael Schaefer, research specialist

Billy Kraft, research technician

North Dakota State University Carrington Research Extension Center

## KEY FINDINGS:

- Applied as two sequential applications 11 days apart, ProPulse (10.3 fl oz/ac) and Endura (8 oz/ac) significantly increased pinto bean yields relative to the non-treated control. Proline (5.7 fl oz/ac) was less effective.

### Concentrations of active ingredients in products evaluated in this trial:

*ProPulse* = 200 grams prothioconazole per liter + 200 grams fluopyram per liter

*Proline* = 480 grams prothioconazole per liter

*Endura* = 700 grams boscalid per kilogram

## SUMMARY OF KEY RESULTS:

| Description (application timing) <sup>y</sup>       | Sclerotinia incidence: <sup>y ‡</sup> | Sclerotinia severity: <sup>x</sup> | Sclerotinia sev. index: <sup>w ‡</sup> | Yield:  | Test weight:             | Seeds per pound |        |
|---|---------------------------------------|------------------------------------|--|---------|--------------------------|-----------------|--------|
|   | Sept. 9-10<br>percent                 | Sept. 9-10<br>percent              | Sept. 9-10<br>percent                  | lbs/ac  | 13.5% moisture<br>lbs/bu | seeds/lb        |        |
| Non-treated (water; A,B)                            | 98 a*                                 | 56 a*                              | 55 b*                                  | 2258 c* | 58.8 a*                  | 1311 ab*        |        |
| Confidential  | 96 a                                  | 49 a                               | 47 ab                                  | 2679 bc | 59.5 a                   | 1275 ab         |        |
| ProPulse 400SC 10.3 fl oz/ac + NIS 0.125% v/v (A,B) | 93 a                                  | 48 a                               | 44 ab                                  | 2895 ab | 59.1 a                   | 1308 ab         |        |
| Proline 480SC 5.7 fl oz/ac + NIS 0.125% v/v (A,B)   | 96 a                                  | 54 a                               | 52 ab                                  | 2441 bc | 59.1 a                   | 1351 b          |        |
| Endura 70WG 8 oz/ac + NIS 0.125% v/v (A,B)          | 83 a                                  | 38 a                               | 33 a                                   | 3296 a  | 59.5 a                   | 1230 a          |        |
|   | F:                                    | 2.62                               | 2.90                                   | 3.47    | 10.01                    | 1.14            | 3.39   |
|   | F > P:                                | 0.0881                             | 0.0681                                 | 0.0418  | 0.0008                   | 0.3820          | 0.0450 |
|   | CV:                                   | 9.5                                | 17.0                                   | 13.1    | 9.4                      | 0.9             | 3.8    |

<sup>y</sup> **Sclerotinia incidence:** The percent of plants exhibiting Sclerotinia stem rot. In each plot, 40 plants were evaluated (20 plants in each of the two center rows of each plot). Disease was assessed at the R7 growth stage (on average, at least one pod per plant changed color/striped).

<sup>x</sup> **Sclerotinia severity:** Disease severity of those plants exhibiting Sclerotinia stem rot. In each plot, 40 plants were evaluated (20 plants in each of the two center rows in each plot). Disease was assessed at the R7 growth stage (on average, at least one pod per plant changed color/striped).

<sup>w</sup> **Sclerotinia stem rot severity index:** Average Sclerotinia stem rot severity (including non-diseased plants). In each plot, 40 plants were evaluated (20 plants in each of the two center rows of each plot). Disease was assessed at the R7 growth stage (on average, at least one pod per plant changed color/striped).

### <sup>y</sup> Fungicide application timing:

**Application A:** July 28 at 6:50 to 7:35 pm; dry beans at 100% bloom (R1 growth stage) just prior to canopy closure, no Sclerotinia present; wind = 2.4 to 6.5 mph out of the southeast, relative humidity = 36.0 to 44.3%, air temperature = 68.5 to 72.8°F.

**Application B:** August 8 at 12:30 to 1:10 pm; dry beans at R3 to R4 growth stage (early to mid pod set), no plants exhibiting wilting symptoms associated with severe Sclerotinia; wind = 4 to 6 mph out of the west to northwest with occasional gusts up to 9.3 mph, air temperature = 70.8 to 72.6°F, relative humidity = 56 to 57%

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

‡ In order to meet model assumptions of normality and homoskedasticity, analysis of variance was conducted on the arcsine transformation of disease incidence and severity index [ $\text{ARCSINE}(x^{0.5})$ ]. For ease of interpretation, treatment means are reported as the (untransformed) percent disease.

## 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.

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## METHODS:

- **Location of trial:** NDSU Carrington Research Extension Center, Carrington, ND.  
**GPS coordinates of research trial location:** 47.5085, -99.1291
- **Tillage:** Disked on May 28, 2013 and cultivated twice (once deep and once shallow) on May 28.
- **Fertility:** 80 lbs/ac of Nitrogen were applied as urea (46-0-0) on May 28 and incorporated to 2 inches deep.
- **Maintenance herbicide applications:** On June 26 (at 8:00 to 9:00 pm) when the dry beans had 1 to 2 trifoliolate leaves, Raptor (2 fl oz/ac; 12.1% ammonium salt of imazamox, 1 lb ai/gal; BASF Corp.), Rezult B (16 fl oz/ac; sodium salt of bentazon, 53% and 5 lbs ai/gal; BASF Corp.), Assure II (10 fl oz/ac; quizalofop p-ethyl, 10.3%; 0.88 lb ai/gallon; DuPont Corp.), 1.5 gallons/100 gallons methylated seed oil (Drexel MES 100, 100% methylated seed oil; Drexel Chemical Company, Memphis, TN), and 2.5 gallons per 100 gallons liquid ammonium sulfate (28-0-0) were applied in 12.9 gallons of water/ac to control red-root pigweed, wild buckwheat, lambsquarters, foxtail barley, and other weeds. On July 5 when the beans had three trifoliolate leaves, Raptor (2 fl oz/ac; ammonium salt of imazamox, 12.1%, 1 lb ai/gal; BASF Corp.), Rezult B (24 fl oz/ac; sodium salt of bentazon, 53% and 5 lbs ai/gal; BASF Corp.), 1.5% (v/v) methylated seed oil (Drexel MES 100, 100% methylated seed oil; Drexel Chemical Company, Memphis, TN), and 2% v/v ammonium sulfate (28-0-0) were applied in 20 gallons of water/ac to control red-root pigweed, mustard, and other small broadleaf weeds.
- **Variety:** 'Lariat' (pinto bean) **Previous crop:** soybeans
- **Experimental design:** randomized complete block **Replicates:** 5
- **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.**
- **Planting date:** May 29, 2013 **Row spacing:** 14 inches **Rows per plot:** 4
- **Seeding rate:** 91,950 pure live seeds/ac (target plant population = 80,000 plants/ac; presumed seedling mortality = 13%)
- **Fungicide application A:** July 28, 2013 at 6:50 to 7:35 pm; dry beans at 100% bloom (R1 growth stage) just prior to canopy closure, no Sclerotinia present; wind = 2.4 to 6.5 mph out of the southeast, relative humidity = 36.0 to 44.3%, air temperature = 68.5 to 72.8°F.
- **Fungicide application B:** August 8 at 12:30 to 1:10 pm; dry beans at R3 to R4 growth stage (early to mid pod set), no plants exhibiting wilting symptoms associated with severe Sclerotinia; wind = 4 to 6 mph out of the west to northwest with occasional gusts up to 9.3 mph, air temperature = 70.8 to 72.6°F, relative humidity = 56 to 57%
- **Fungicide application details:** Fungicides were applied with a 57-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:** The trial was established on a site with a previous history of Sclerotinia epidemics. In addition, sclerotia of Sclerotinia sclerotiorum obtained from a sunflower processing plant were applied to plots on July 15. On July 15, approx. 1.25 grams of sclerotia were placed approx. 0.25 inches deep in each of eight locations per plot. Prior to placement in the field, the sclerotia were artificially vernalized by alternating them between a freezer (-20°C for at least 12 hours) and room temperature (20 to 25°C for at least 8 hours) a minimum of eight times. To facilitate disease development, overhead irrigation was applied to this trial through microsprinklers established on a 20 ft x 20 ft grid. Sprinklers were operated for 5 minutes every 20 minutes during the late evening, nighttime, and early morning hours (approximately 8 pm to 8 am) daily during the bloom period.
- **Sclerotinia disease assessment:** Sclerotinia disease incidence and severity were assessed Sept. 9-10 at the R7 growth stage (at least one pod per plant changed color/ striped). In each plot, 40 plants (10 plants in each of two locations in each row) were evaluated individually for the percent of the plant exhibiting Sclerotinia stem rot disease symptoms.
- **Harvest date:** The beans were manually pulled on October 4 at maturity and harvested October 24; cool, wet weather delayed harvest.
- **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 arcsine transformation ( $\text{ARCSINE}(x^{0.5})$ ) was applied to the Sclerotinia incidence and severity index data. All other data met model assumptions without systematic transformation. 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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