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Field evaluation of fungicides for management of Ascochyta blight of chickpeas

Hofflund / Nesson Valley, ND –
25 miles east of Williston (2012)

Tyler Tjelde, Irrigation Agronomist, NDSU Williston Res. Extension Ctr,, Nesson Valley Irrigation Research Site
Michael Wunsch, Plant Pathologist, NDSU Carrington Research Extension

KEY FINDINGS:

- **Priaxor** (fluxapyroxad + pyraclostrobin) **showed excellent efficacy against Ascochyta blight on chickpeas.**
- **Priaxor performed similarly when applied at 4 fl oz/ac and 6 fl oz/ac.**
- **Rotational strategies with Proline and Priaxor performed equivalently as sequential applications of Proline.**
- **Omega** (fluazinam)**, Bravo Top** (difenoconazole + chlorothalonil)**, and Vertisan** (penthiopyrad) **showed efficacy against Ascochyta blight on chickpeas.** Additional testing is needed to optimize the use of these products in a fungicide resistance management program. For Bravo Top and Vertisan, additional testing is needed confirm that their efficacy is equivalent to Proline and Priaxor, respectively, which they would replace in a fungicide resistance management program.

DETAILED RESULTS:

The fungicides BRAVO TOP, OMEGA, and QUASH are currently not registered for use on chickpeas and should not be used. Future registration of these fungicides is anticipated, and results for these products are provided for reference only.

		Ascochyta Blight			Test				
		Severity [z‡]	Severity [z]	Yield [‡]	weight	Seed diameter [y]			
		July 7 [x]	July 19 [x]			> 10.3 mm	9.5-10.3 mm	8.7-9.5 mm	< 8.7 mm
	Treatment (fungicide application timing) [w]	percent	percent	lbs/ac	lbs/bu	percent	percent	percent	percent
1	**Non-treated check** (water; **A,B,C,D**)	**3** abc*	**64** bcd *	**2065** bc *	**60.9** a *	**0.0**	**5** bc *	**24** d *	**72** d *
2	**Priaxor 500SC** 4 fl oz/ac **(A,B,C,D)**	**1** ab	**25** a	**2930** ab	**62.0** a	**0.0**	**15** ab	**49** abc	**36** abc
3	**Priaxor 500SC** 6 fl oz/ac **(A,B,C,D)**	**1** ab	**31** a	**2932** ab	**62.6** a	**0.0**	**14** ab	**47** abc	**39** abc
4	**Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(A,B,C,D)**	**2** ab	**27** a	**3437** a	**62.1** a	**0.0**	**14** ab	**46** abc	**40** abc
5	**Omega 500F** 13.6 fl oz/ac **(A,B,C,D)**	**2** ab	**34** a	**2921** ab	**61.7** a	**0.1**	**12** abc	**41** bc	**47** abc
6	**Omega 500F** 8 fl oz/ac **(A) / Priaxor 500SC** 4 fl oz/ac **(B,D) / Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(C)**	**4** abc	**41** abc	**2773** abc	**62.4** a	**0.1**	**15** ab	**47** abc	**38** abc
7	**Omega 500F** 13.6 fl oz/ac **(A) / Priaxor 500SC** 4 fl oz/ac **(B,D) / Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(C)**	**3** abc	**40** abc	**2877** ab	**62.6** a	**0.1**	**14** ab	**42** abc	**44** abc
8	**Omega 500F** 16 fl oz/ac **(A) / Priaxor 500SC** 4 fl oz/ac **(B,D) / Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(C)**	**4** abc	**39** abc	**2468** abc	**62.7** a	**0.2**	**15** a	**47** abc	**37** abc
9	**Bravo WS** 1.5 pt/ac **(A) / Priaxor 500SC** 4 fl oz/ac **(B,D) / Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(C)**	**3** abc	**31** a	**3137** a	**63.4** a	**0.1**	**10** abc	**42** abc	**47** abc
10	**Non-treated check** water **(A) / Priaxor 500SC** 4 fl oz/ac **(B,D) / Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(C)**	**9** c	**66** cd	**2670** abc	**62.1** a	**0.0**	**11** abc	**39** bc	**50** bc
11	**Omega 500F** 13.6 fl oz/ac **(A,B) / Priaxor 500SC** 4 fl oz/ac **(C) / Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(D)**	**5** bc	**40** abc	**2749** abc	**61.4** a	**0.0**	**13** abc	**43** abc	**44** abc
12	**Non-treated (A,B) / Priaxor 500SC** 4 fl oz/ac **(C) / Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(D)**	**6** bc	**75** d	**1914** c	**62.5** a	**0.0**	**2** c	**19** d	**79** d
13	**Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(A,C) / Priaxor 500SC** 4 fl oz/ac **(B,D)**	**3** abc	**25** a	**3378** a	**61.4** a	**0.1**	**17** a	**48** abc	**35** abc
14	**Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(A,C) / Priaxor 500SC** 6 fl oz/ac **(B,D)**	**2** abc	**30** a	**3175** a	**61.9** a	**0.2**	**19** a	**49** ab	**32** ab
15	**Priaxor 500SC** 4 fl oz/ac **(A,C) / Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(B,D)**	**3** abc	**29** a	**3095** ab	**61.8** a	**0.0**	**15** a	**45** abc	**40** abc
16	**Priaxor 500SC** 6 fl oz/ac **(A,C) / Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(B,D)**	**4** bc	**33** a	**3209** a	**62.3** a	**0.1**	**11** abc	**47** abc	**41** abc
17	**Priaxor 500SC** 4 fl oz/ac **(A,C) / Bravo Top 4.59SC** 2 pt/ac **(B,D)**	**2** ab	**32** a	**3046** ab	**63.0** a	**0.1**	**13** abc	**47** abc	**40** abc
18	**Bravo Top 4.59SC** 2 pt/ac **(A,C) / Priaxor 500SC** 4 fl oz/ac **(B,D)**	**1** ab	**38** ab	**2708** abc	**62.2** a	**0.0**	**14** ab	**42** abc	**43** abc
19	**Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(A,C) / Vertisan 1.67EC** 20 fl oz/ac + **NIS** 0.25% v/v **(B,D)**	**3** abc	**32** a	**3065** ab	**61.8** a	**0.1**	**15** ab	**42** abc	**43** abc
20	**Vertisan 1.67EC** 20 fl oz/ac + **NIS** 0.25% v/v **(A,C) / Proline 480SC** 5.7 fl oz/ac + **NIS** 0.125% v/v **(B,D)**	**6** bc	**45** abc	**2716** abc	**62.2** a	**0.1**	**11** abc	**38** c	**51** c
21	**Proline 480SC** 5.7 fl oz/ac + **Bravo WS** 1.5 pt/ac + **NIS** 0.125% v/v **(A,C) / Priaxor 500SC** 4 fl oz/ac **(B,D)**	**0** a	**35** a	**3071** ab	**61.9** a	**0.0**	**18** a	**53** a	**29** a
22	**Quash 50WDG** 3 oz/ac + **NIS** 0.25% v/v **(A,C) / Priaxor 500SC** 4 fl oz/ac **(B,D)**	**2** abc	**41** abc	**2640** abc	**62.5** a	**0.2**	**14** ab	**43** abc	**42** abc
	***F*:**	3.95	6.53	3.37	1.67	1.16	3.88	13.34	11.29
	***P* > *F*:**	< 0.0001	< 0.0001	0.0003	0.0762	0.3320	< 0.0001	< 0.0001	< 0.0001
	CV:	37.7	26.9	1.91	1.38	205.9	29.7	10.0	15.4

[z] **Ascochyta disease severity:** Percent of the canopy exhibiting symptoms of Ascochyta.

[y] **Seed size:** Seed size was determined by assessing the percent (by weight) of a 200-gram seed sample that passed through seives with round 26/64, 24/64, and 22/64-inch diameter holes.

[x] The chickpeas were in full bloom on July 7 and July 19.

[w] **Fungicide application timing:**

Application A: June 27, 2012 at 9:30-11:00 am. Chickpeas at bloom initiation (less than 10% of plants with at least one open blossom); canopy was closed; trace levels of Ascochyta present. Wind = 12-16 mph, temperature = 66-69˚F, relative humidity = 40-45%.

Application B: July 10, 2012 at 2:00-4:00 pm. Wind = 9 to 10 mph, temperature = 84 to 91˚F, relative humidity = 30 to 40%.

Application C: July 20, 2012 at 7:00-10:00 am. Wind = 6.5 to 9 mph, relative humidity = 60-88%, temperature = 69 to 75˚F.

Application D: August 2, 2012 at 11:30 am - 1:00 pm. Wind =7 to 8 mph, relative humidity = 41-47%, temperature = 78 to 82˚F.

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

‡ In order to meet meet model assumptions of normality and homoskedasticity, analysis of variance was conducted on the natural-log transformation of disease severity and yield [LN(x + 1) for data sets including values < 1.0; otherwise, LN(x)]. **For ease of interpretation, treatment means are reported as the untransformed yield (lbs/ac) and disease severity (percent).**

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Tyler Tjelde, Irrigation Agronomist, NDSU Williston Research Extension Center, Nesson Valley Irrigation Research Site

Michael Wunsch, Plant Pathologist, NDSU Carrington Research Extension Center 701-652-2951 / michael.wunsch@ndsu.edu

METHODS:

- **Location of trial:** NDSU Williston Research Extension Center, Nesson Valley Irrigation Research Site, Williston, ND.
- **GPS coordinates of research trial location:** 48.167,-103.104
- **Soil type:** Lihen - fine sandy loam
- **Soil preparation:** conventional tillage (fall - disked once, ripped twice, and mulched once; spring - harrowed once with a noble spring tooth harrow)
- **Seeding equipment:** double-disc seeder (plot cone seeder)
- **Variety:** CDC 'Frontier'
- **Experimental design:** randomized complete block **Replicates:** 4
- **Seeded plot size:** 5 feet wide (center-to-center) x 18 feet long **Harvested plot size:** 5 feet wide (center-to-center) x 14 feet long
- **Row spacing:** 7 inches **Rows per plot:** 6 **Non-treated buffer plots were established between treatment plots.**
- **Previous crop:** durum wheat
- **Planting date:** May 2, 2012 **Seeding rate:** targeted plant population = 4.5 plants/square foot. Stand count assessments taken on May 29 showed an average stand count of 4.3 plants/square foot.
- **Seed treatment:** Cruiser 5FS 1.28 fl oz/cwt + ApronMaxxRTA 5.0 fl oz/cwt + Mertect 340F 2.04 fl oz/cwt
- **Fungicide application A:** June 27, 2012 at 9:30-11:00 am. Chickpeas at bloom initiation (less than 10% of plants with at least one open blossom); canopy was closed; trace levels of Ascochyta present. Wind = 12-16 mph, temperature = 66-69˚F, relative humidity = 40-45%.
- **Fungicide application B:** July 10, 2012 at 2:00-4:00 pm. Wind = 9 to 10 mph, temperature = 84 to 91˚F, relative humidity = 30 to 40%.
- **Fungicide application C:** July 20, 2012 at 7:00-10:00 am. Wind = 6.5 to 9 mph, relative humidity = 60-88%, temperature = 69 to 75˚F.
- **Fungicide application D:** August 2, 2012 at 11:30 am - 1:00 pm. Wind =7 to 8 mph, relative humidity = 41-47%, temperature = 78 to 82˚F.
- **Fungicide application details:** Fungicides were applied with a 56-in hand boom with four equally spaced flat-fan Spraying Systems TeeJet 8002VS nozzles. Applications were made at 40 psi in 20 gal/ac water.
- **Ascochyta inoculation details:** To promote disease development, guard and buffer plots were inoculated with laboratory-grown pycnidiospores of *Ascochyta rabiei* at 11:15 to 11:45 pm on July 2. Spores of A. rabiei were grown on potato dextrose agar, suspended in water, and applied to the guard plots at a spore concentration of 1.25*106 spores/ml and an application rate of 50 ml per plot. The spores were applied by tossing the spore solution over the center of each guard and buffer plot. To facilitate disease establishment, the chickpeas were irrigated with 0.5 inches of water earlier in the evening; the canopy was wet at the time of spore application.
- **Disease assessments:** Ascochyta severity was assessed as the percent of the canopy exhibiting Ascochyta disease symptoms. Severity was evaluated at four locations per plot.
- **Desiccation:** This trial was desiccated with paraquat (Gramoxone at 2 pts/ac + NIS at 2.5 oz/ac in 15 gallons water/ac) on August 21, 2012.
- **Harvest date:** September 7, 2012.
- **Seed size:** Seed diameter was determined by assessing the percent (by weight) of a 200-gram seed sample that passed through sieves with round 26/64, 24/64, and 22/64-inch diameter holes.
- **Statistical analysis:** Data were evaluated with analysis of variance . The assumption of constant variance was assessed by plotting residuals against predicted values, and the assumption of normality was assessed with a normal probability plot. To meet model assumptions of homoskedasticity, a systematic natural-log transformation [LN(x+1)] was applied to the July 5 disease severity data and a systematic square-root transformation was applied to the yield data. All other data met model assumptions. 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. Analyses were conducted with replicate and treatment as main factor effects, and they were implemented in PROC GLM of SAS (version 9.2; SAS Institute, Cary, NC).

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We gratefully acknowledge **Syngenta Crop Protection** for donating the seed treatment products Cruiser and Mertect used in this trial and **JM Grain** for helping us obtain seed of CDC Frontier chickpeas for use in this trial.

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 chickpea variety planted, crop growth stage at the time of fungicide application, and other factors.
- This report summarizes fungicide performance as tested at the NDSU Williston Research Extension Center's Nesson Valley Irrigation Research Site in 2012 under the conditions partially summarized in the methods section (above).
- 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.