Influence of Spray Volume and Nozzle Orientation on Fungicide Efficacy for Control of Fusarium Head Blight on Durum

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OBJECTIVE

The study objective was to determine if spray volume and nozzle orientation affected the efficacy of fungicide for control of Fusarium head blight (FHB) on durum.

INTRODUCTION

Fungicide has typically reduced disease losses from Fusarium head blight (FHB) by about 50% when averaged over many years of trials. New fungicide chemistries that would be available to producers in fall of 2006 have potential to improve on these percentages. Multiple management strategies will always be needed to control FHB. Research has shown that a greater area on the spike can be covered by spray solution when spray volumes are increased. However, when volumes are increased, the fungicide concentration in the spray solution is decreased. The spray volume where total fungicide deposited on the grain spike actually decreases is unknown. Previous reports have identified a pair of nozzles mounted on a double swivel and oriented to spray forward and backward as providing improvement on spike coverage. This nozzle configuration has only been adapted by some of the spray applicators.

MATERIALS AND METHODS

A series of studies were initiated at the Langdon Research Extension Center using ground application equipment to compare 5, 10, and 20 GPA spray volumes and nozzles oriented forward (F) or forward and backward (F+B) with 10 GPA. Two studies were conducted on 'Lebsock' durum in 2004 and 2005. The studies were designed as a randomized complete block with five and six replicates, respectively. The trials were planted in early May on soil type Barnes/Svea complex. The trial was planted in a block with a double-disk drill rows spaced 7-inches apart. Before heading the block was divided into plots 12 x 30 ft. The fungicides were applied with tractor with a CO_2 delivery system. The tractor traveled at 6 mph. The spray volumes were attained by applying the fungicide through one or two rows of nozzles two feet apart on the right side of the tractor and adjusting the pressure to maintain the same flow through the nozzle orifices. A Fusarium barley/wheat inoculum was hand spread 21 and 14 days prior to heading at 122 grams per plot to maximize potential for FHB disease. Additionally in 2004 a solution of ascospores was sprayed on the study immediately after fungicide application. The treatments were 5 GPA (XR8001 nozzles oriented F on one boom), 10 GPA (XR8001 nozzles oriented F on two booms), 10 GPA (XR8001 nozzles oriented F+B on one boom), 20 GPA

(XR8001 nozzles oriented F+B on two booms), and an untreated. Bayer CropScience experimental fungicide JAU 6476, prothioconazole, at 5.7 fl oz /acre was tank mixed with Induce adjuvant (Helena Chemical Co.) @ 0.125% v/v. North Dakota State University Extension recommended production practices for Northeast North Dakota were followed. A visual estimation was made from 20 samples per plot collected 20 days after fungicide application to estimate the incidence (number of spikes infected) and field severity (number of FHB infected kernels per head divided by total kernels per individual spike) of FHB in each plot. Each plot was harvested with a Hege plot combine and the grain sample cleaned and processed for yield, and test weight determination. A sub sample was ground and analyzed for the toxin deoxynivalenol (DON) by North Dakota State University. Data was analyzed with the general linear model (GLM) in SAS. Least significant differences (LSD) were used to compare means at the 5% probability level (Table 1).

RESULTS AND DISCUSSION

Fusarium head blight incidence (Table 2) was reduced by fungicide treatment. No differences were measured among spray volumes and nozzle orientations for FHB incidence. Fusarium head blight field severity was reduced by fungicide treatment on the early plant study. No differences in field severity were determined among any of the spray volumes or orientations. Yield was increased by the 5 GPA spray volume fungicide treatment compared to the untreated. No differences were measured among fungicide treatments. Test weights were not different among treatments. Concentration of DON was significantly reduced by fungicide but was not different among spray volumes or nozzle orientations. No advantage was measured by increased spray volumes or the F+B nozzle configuration over lower volumes and the F nozzle configuration.

Table 1. Source of variation and confidence levels for significant differences among Fusarium head blight (FHB) incidence and field severity, yield, test weight, and deoxynivalenol (DON) by spray volume (treatment) and environment on durum Langdon, 2004 and 2005.

	Fusarium head blight				
Source of Variation	Incidence	Field Severity	Yield	Test weight	DON
Environ.	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Rep (Environ.)	0.3549	0.4068	0.0263	0.0207	0.0024
Treatment	0.0089	0.0004	0.0720	0.7980	<0.0001
Environ*Trt	0.6412	0.4059	0.2698	0.2522	0.9535
% C.V.	34	49	11	2	46

Table 2. Fusarium head blight incidence and field severity, yield, test weight, and deoxynivalenol (DON) by spray volume and nozzle orientation in durum averaged over years, Langdon 2004 and 2005.

		Fusarium head blight				
Spray Volume (GPA)	Nozzle Orientation	Incidence (%)	Field Severity (%)	Yield (Bu/ac)	Test weight (Lb/bu)	DON (Ppm)
untreated		62	5.2	57..3	58.4	5.5
5	F	43	2.6	64.1	58.9	2.4
10	F	40	2.3	59.5	58.7	2.3
10	F+B	42	2.6	63.9	59.0	2.5
20	F+B	44	2.7	63.0	58.7	2.7
$LSD_{(0.05)}$		19.3	1.9	6.8[Z]	NS	1.7

[Z] P=0.1

Table 3. Fusarium head blight incidence and field severity, yield, test weight, and DON by spray volume and nozzle orientation in durum, Langdon 2004.

		Fusarium head blight				
Spray Volume (GPA)	Nozzle Orientation	Incidence (%)	Field Severity (%)	Yield (Bu/ac)	Test weight (Lb/bu)	DON (Ppm)
untreated		46	4.6	72.7	60.7	3.5
5	F	19	1.1	79.0	60.2	0.8
10	F	15	0.9	70.7	60.3	0.7
10	F+B	16	0.7	80.8	60.5	0.7
20	F+B	17	1.3	80.8	60.0	0.9

Table 4. Fusarium head blight incidence and field severity, yield, test weight, and deoxynivalenol (DON) by spray volume and nozzle orientation in durum Langdon, 2005.

		Fusarium head blight				
Spray Volume (GPA)	Nozzle	Incidence (%)	Field Severity (%)	Yield (Bu/a)	Test Weight (Lb/bu)	DON[z] (Ppm)
untreated		76	5.6	44.5	56.4	7.2
5	F	62	3.9	51.8	57.8	3.7
10	F	61	3.5	50.3	57.3	3.6
10	F+B	64	4.2	49.8	57.7	4.0
20	F+B	66	3.9	48.2	57.6	4.2

[z] Deoxynivalenol