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

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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 barley.

INTRODUCTION

Fungicide has typically reduced disease losses from Fusarium head blight (FHB) by about 50% when averaged over many years of trials. New fungicide chemistry that would be available to producers in the fall of 2006 has potential to improve on these percentages. Multiple management strategies will always be needed to control FHB. Research has shown that a larger area on the spike can be covered with increased spray volumes. 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 been adapted by only a small number of 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 'Tradition' barley in 2005. The study designs were a randomized complete block with six replicates. The trials were planted in early May on two different station locations, soil type Barnes/Svea complex. The trial was planted in a block with a double disk drill with rows spaced 7-inches apart. Before heading the block was divided into plots 12 x 30 ft. The fungicides were applied with a tractor with a CO_2 delivery system. The travel speed was 6 mph. The spray volumes were attained by applying the fungicide through one or two rows of nozzles spaced two feet apart with a spray boom mounted on the right side of the tractor. Flat fan nozzles and twinjet nozzles were used to apply the fungicide. A twinjet nozzle has two orifices directing the spray forward 30 degrees from vertical and another directing the spray 30 degrees back from vertical. A pressure regulator was used

to adjust the pressure. A barley Fusarium inoculum was hand spread 21 and 14 days prior to heading at 122 grams per plot to maximize potential for FHB disease. 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, protein, plump, and test weight. A sub sample was ground and analyzed for 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.

Study 1. The treatments were 5 GPA (XR8001 nozzles oriented forward on one boom), 10 GPA (XR8001 nozzles oriented forward on two booms), 10 GPA (TJ8002 nozzles on one boom), 20 GPA (TJ8002 nozzles on two booms), and an untreated plot. Folicur, tebuconazole, fungicide at 2 fl oz/acre was tank mixed with Preference adjuvant @ 0.25% v/v and Interlock Adjuvant at 2 fl oz/acre. Preference and Interlock are proprietary compounds from Agriliance, LLC. The previous crop was small grains. The wind was very strong on the day of application blowing opposite the direction of travel. This plot was planted on May 7.

Study 2. 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 plot. 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. The previous crop was canola. This study was planted on 12 May about 10 days later than study 1.

RESULTS AND DISCUSSION

FHB incidence (Table 2) was reduced by fungicides applied with the 5 GPA treatment. No differences were measured among spray volumes and nozzle orientations for FHB incidence. FHB field severity was reduced by all fungicide treatments on the early planted study. No differences in field severity were determined among any of the spray volumes or orientations. Plump was greater than 85% and fungicide increased plump for the 10 GPA F compared to the untreated. DON was reduced by the 5 and 10 GPA F treatments over the untreated. No advantage was measured with 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, protein, plump, and deoxynivalenol (DON) compared by spray volume (treatment) and environment on barley Langdon, 2005.

Source of Variation	Fusarium Head Blight Incidence	Fusarium Head Blight Field Severity	Yield	Test Weight	Plump	DON	Protein
Rep (Envir.)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0767	<0.0001
Treatment	0.0287	0.0032	0.6586	0.4275	0.0584	0.0018	0.2938
Envir.*Treat.	0.2244	0.0013	0.4388	0.4109	0.1230	0.2486	0.6575
% C.V.	13	33	7	3	4	42	3

Table 2. Fusarium head blight (FHB) incidence and field severity, yield, test weight, protein, plump, and deoxynivalenol (DON), and dilution compared by spray volume (treatment) averaged across environments on barley Langdon, 2005.

Spray Volume	Fusarium Head Blight Incidence (%)	Fusarium Head Blight Field Severity (%)	Yield (Bu/a)	Test Weight (Lb/bu)	Plump (%)	DON (Ppm)	Protein (%)
Untreated	90	17.6	92.6	46.3	85.6	2.8 A	11.6
5	77	11.9	97.2	46.5	89.5	1.6 B	11.7
10 F	78	12.5	95.7	47.1	90.2	1.4 B	11.6
10 F+B	82	12.0	94.5	47.1	89.6	1.7 A B	11.6
20	80	10.6	94.5	46.5	88.1	1.7 A B	11.8
LSD $_{(0.05)}$	12.2	5.0	NS	NS	4.4	1.0	NS

Table 3. Fusarium head blight (FHB) incidence and field severity, yield, test weight, protein, plump, and deoxynivalenol (DON), and dilution compared by spray volume (treatment) and environment on barley Langdon, 2005.

	Fusarium Head Blight						
Spray Volume	Incidence (%)	Field Severity (%)	Yield (Bu/a)	Test Weight (Lb/bu)	Plump (%)	DON (Ppm)	Protein (%)
Early Plant							
Untreated	88	18.5	109.4	48.8	92	3.2	11.5
5	66	8.8	112.2	49.2	92	2.2	11.8
10 F	68	8.5	106.9	49.2	94	1.4	11.5
10 TJ	71	6.0	107.6	48.9	92	1.6	11.5
20 TJ	69	4.2	110.4	49.2	94	1.6	11.8
Late Plant							
Untreated	93	16.7	78.5	44.1	80	2.5	11.7
5	88	15.0	84.8	44.3	87	1.2	11.6
10 F	88	16.5	86.3	45.4	87	1.4	11.6
10 F+B	93	17.9	83.6	45.6	88	1.9	11.8
20 F+B	91	17.0	81.2	44.3	84	1.9	11.9

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