INFLUENCE OF SPRAY VOLUME AND NOZZLE ORIENTATION ON FUNGICIDE EFFICACY FOR CONTROL OF FUSARIUM HEAD BLIGHT

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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 by 2007 have potential to improve on these percentages. Multiple management strategies will always be needed to control FHB. Research with tracer dye has shown that a greater area on the spike can be covered 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 active ingredient 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 was a significant improvement over vertically oriented nozzle configurations typically used to apply herbicide but has only been adapted by only a limited number of fungicide applicators. These studies identify differences associated with the different spray volumes and two nozzle configurations while maintaining a "fine" drop size.

Plot Spraying With Tractor Mounted Spray Systems

A Single Forward Facing Nozzle for Fungicide Application on grain heads

MATERIALS AND METHODS

•A series of studies were initiated at the North Dakota State University-Langdon Research Extension Center using ground application equipment to determine fungicide efficacy. Fungicide was applied to control FHB at 5, 10, and 20 GPA spray volumes with nozzles oriented forward (F) or forward and backward (F+B).

•The studies were conducted over several years. The studies were designed as a randomized complete block with a minimum of four replications. The soil type for the trials was a Barnes/Svea complex. The studies were planted in blocks with a double-disk type drill with either a 6 or 7-inch spacing. Each plot was spread with a Fusarium inoculum two weeks prior to heading (100 to 200 grams$^{\text{-plot}}$). 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 spaced two feet apart on the left side of the tractor and adjusting the pressure to maintain the same flow through the nozzle orifices.

•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 fungicide Proline, prothioconazole, at 5.7 fl oz /acre was tank mixed with Induce adjuvant (Helena Chemical Co.) @ 0.125% v/v.

Table 1. FHB incidence and field severity, plump and deoxynivalenol (DON) concentration by spray volume and nozzle orientation on 'Tradition' barley, Langdon 2005.

Spray Volume & Nozzle Orientation	FHB Incidence (%)	FHB Field Severity (%) (early)	FHB Field Severity (%) (late)	Plump (%)	DON (ppm)
untreated	90	18.5	16.7	86	2.8
5 GPA F	77	8.8	15.0	89	1.6
10 GPA F	78	8.5	16.5	90	1.4
10 GPA F+B	82	6.0	17.9	90	1.7
20 GPA F+B	80	4.2	17.0	88	1.7
LSD $_{(0.05)}$	8.6	3.6		3.1	0.7

Table 2. FHB incidence, yield, test weight, and deoxynivalenol (DON) concentration by spray volume and nozzle orientation on 'Knudson and Glenn' hard red spring wheat, Langdon 2005 and 2006.

Spray Volume & Nozzle Orientation	FHB Incidence (%)	Yield (bu/a)	Test Weight (lb/bu) 2005	Test Weight (lb/bu) 2006	DON 2005 (ppm)
untreated	78	53.3	60.2	61.2	3.3
5 GPA F	67	57.7	61.0	60.8	0.8
10 GPA F	75	58.9	60.6	61.3	1.7
10GPA F+B	65	59.1	61.3	61.3	1.1
20 GPA F+B	67	57.3	60.7	60.6	1.5
LSD $_{(0.05)}$	9.2	3.4	0.6		0.8

Dual Boom Sprayer

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Table 3. FHB incidence and field severity, yield, test weight, and deoxynivalenol (DON) concentration by spray volume and nozzle orientation on 'Lebsock' durum, Langdon 2004 and 2005.

Spray Volume & Nozzle Orientation	FHB Incidence (%)	FHB Field Severity (%)	DON (ppm)
untreated	62	5.2	5.5
5 GPA F	43	2.6	2.4
10 GPA F	40	2.3	2.3
10GPA F+B	42	2.6	2.5
20 GPA F+B	44	2.7	2.7
LSD $_{(0.05)}$	14.3	1.4	1.3

RESULTS AND DISCUSSION

Fungicide application timing may be the most important management decision a producer faces when environmental conditions favor FHB infections to small grains. Efficacy of fungicide has been shown to be reduced when applied later than four days after initial infection and though still a prudent management decision, full efficacy may not be achieved. Applying fungicide in lower volumes of water increases the efficiency of application allowing growers to apply fungicide timely to a greater percentage of their acreage susceptible to FHB. In addition, fungicide application costs are reduced. Reducing spray volumes to 10 GPA should not reduce fungicide efficacy for control of FHB.

Table 4. Source of variation and probability levels for significant differences by FHB incidence and field severity, yield, test weight, plump, DON, and protein by crop, Langdon.

Source of Variation	FHB Incidence	FHB Field Severity	Yield	Test Weight	Plump	DON	Protein
Barley							
Treatment	0.0287	0.0032	0.6586	0.4275	0.0584	0.0018	0.2938
Environment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.3648	0.1472
Env*Trt	0.2244	0.0013	0.4388	0.4109	0.1230	0.2486	0.6575
% C.V.	13	33	7	3	4	42	3
HRSW							
Treatment	0.0346	0.2735	0.0074	0.0568	na	<0.0001	0.8046
Environment	0.3099	0.0008	<0.0001	0.0582	na	na	<0.0001
Env*Trt	0.7911	0.1334	0.2874	0.0368	na	na	0.1517
% C.V.	16	60	7	1		39	2
Durum							
Treatment	0.0120	0.0004	0.0720	0.7980	na	<0.0001	na
Environment	<0.0001	<0.0001	<0.0001	<0.0001	na	<0.0001	na
Env*Trt	0.6412	0.4059	0.2698	0.2522	na	0.9535	na
% C.V.	34	49	11	2		46	