The Influence of Nozzle Orientation on Control of Fusarium Head Blight in Barley.

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Introduction

North Dakota State University researchers recognized very early that the small grain heads were not suited to receive fungicides applied with traditional spray application technologies used to apply herbicides. Early assessments using a fluorescent dye and photographed small grain heads showed major improvements in coverage were attainable by angling the nozzle orifices to spray the side of the grain head and by adding an additional nozzle oriented to spray the backside of the heads. Neither technique has been adopted by producers as widely as the benefits warranted. One of the major complaints from applicators has been that the forward/backward nozzle mounted on the double swivel could be high maintenance and is subject to breakage. Further study has shown that when travel speed is greater than walking speed (about 3.5 mph), typically the method of applying fungicide by most researchers, the advantage of the backward facing nozzle is considerably less. The grain spike is also a much different structure than depicted with a photograph. This study was an effort to confirm those results using different methodology.

Materials and Methods.

'Stellar' cultivar barley was planted in a block in May 2006 at the Langdon Research Extension Center to an area previously cropped field pea with a double-disk type grain drill. After emergence, the plots, 12 x 30 ft, were identified by driving a tractor in a straight line, east/west and north/south direction. Plots were arranged in a randomized complete block design with four replicates. Data was collected from areas sprayed with a tractor equipped with a side-mounted boom spraying a six foot wide area of the plot. Each plot was hand-broadcast with a Fusarium inoculum three and two weeks prior to head emergence to improve chance of development of Fusarium head blight (FHB) disease. The sprayer consisted of four nozzles spaced twenty inches apart mounted on a double swivel with the back facing orifice capped. The sprayer was calibrated to apply the fungicide at 10 GPA at 40 psi. The tractor travel speed was 6 mph. Treatments included Prosaro, prothioconazole, (Bayer CropScience) fungicide tank mixed with Induce adjuvant (Helena Chemical Co.). The fungicide rate was 6.5 fl. oz. per acre. Treatments were XR8002 nozzles orient horizontal, 30 degrees, 60 degrees and 90 degrees downward from horizontal, an untreated and an XR8001 nozzle oriented 30 degrees downward from horizontal with two rows of nozzles to apply the 10 gallons per acre. In addition, a food-grade tracer dye (FD & C Blue #1) was added to each spray

solution at a rate of 44 grams per acre. Barley production recommendations for northeast North Dakota from the North Dakota State University Extension Service were followed.

After spraying, 10 heads were selected from each plot, deposited in an Erlenmeyer type flask, and sealed with a rubber stopper. Eighty ml of 90% ethyl alcohol was added to the flask and shaken for three minutes with a wrist-action type shaker (Model BT, Burrell Scientific Instruments and Laboratory Supplies, Pittsburgh, Pennsylvania 15219). A sub sample of the wash solution was measured with a Jenway spectrophotometer (Jenway, Model 6300, , Dunmow, Essex CM6 3LB England) and an absorbance of the tracer dye recorded The absorbance rating was taken to determine differences in the amount of tracer dye deposited on the grain spike (a larger absorbance value is the result of more tracer dye in the solution). A visual estimation of disease incidence (number of spikes infected) and field severity was made from 20 heads per plot at early dough stage. Field severity rating is the number of FHB infected kernels per head divided by total kernels per individual spike. All plots were harvested with a Hege plot combine and the grain sample was cleaned and processed for yield, plump, test weight, and protein. 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.

Results

The growing season was drier and warmer than several previous years at the Langdon Research/Extension Center. Disease development was minimal and differences in yield and other quality factors were likely related to the environmental conditions and differences relating to the water holding capacity of the different textures in the soils. No differences were measured in yield, test weight, plump, and protein among treatments as shown in table 1. The greatest absorbance was measured with both nozzle types oriented 30 degrees downward from horizontal, the recommended orientation for applying fungicides for control of FHB. Orientations of horizontal and 60 degrees downward from horizontal were not different statistically but a downward trend showed decreasing deposition as orientation increased or decreased from 30 degrees.

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Table 1. Barley Test Results for 2006

Nozzle	Orientation Degrees from Horizontal	Yield (bu/a)	Test Weight (lb/bu)	Plump (%)	Protein (%)	Absorbance Mean	
XR8002	0	130.5	48.2	91	10.6	.251	A
XR8002	30	107.9	47.6	89	10.6	.292	A
XR8002	60	129.0	48.1	91	10.7	.225	A B
XR8002	90	123.2	47.6	90	10.6	.158	B
XR8001	30	127.3	48.1	91	10.6	.302	A
untreated		118.5	47.6	89	10.6	.067	C
%C.V		12	2	4	3	32	
Pr>F		0.1249	0.5097	0.7700	0.9522	<0.0001	