Characterizing Parameters of Air Delivery Spray Systems to Maximize Fungicide Efficacy on Small Grain

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Abstract

Several major manufacturers of ground application equipment (e.g. Hardi Spray Systems and Spray-Air Technologies Inc.), manufacture and sell sprayers that use an air stream to assist in delivering the spray solution to the plant canopy. These sprayers have been shown to offer several unique performance characteristics. First, the air stream minimizes spray drift by overpowering the ambient wind and carrying the smaller spray droplets to the target. Second, the energy of the air stream tends to carry the small droplets (less than 200 microns) deeper into the plant canopy. Third, the turbulence of the air stream assists in more uniformly depositing the spray drops in the hard-to-reach areas of the canopy. The second and third characteristics would be important in controlling foliar diseases. The air stream, depending on velocity, also would be able to alter the orientation of the grain head and change potential deposition. Our objective is to characterize the effects of varying the speed of the air stream, drop sizes and application angles for improved fungicide efficiency to control Fusarium head blight on spring barley and hard red spring wheat (HRSW). The two studies were randomized complete block designs with factorial arrangements and replication. Factors included three drop sizes, three air speeds, and three spray angles. Prosaro fungicide and Induce adjuvant were applied at 6.5 fl. oz/acre and 0.125% v/v to control FHB.

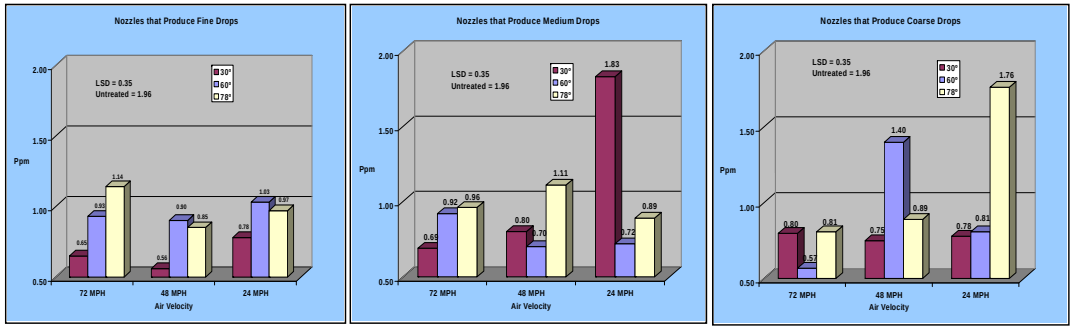

Figure 1. Deoxynivalenol concentration (DON) by air velocity, orifice orientation and drop size on barley, Langdon 2007.

Figure 2. Air assist sprayers push the grain heads forward to help improve coverage when applying fungicides.

Table 1. FHB % incidence averaged across orifice angles and air velocities on HRSW Langdon, 2007.

Orifice Angle F&Down	Air Velocity (MPH)	FHB % Incidence
30º	72	81.7
	48	76.1
	24	71.7
60º	72	83.3
	48	74.9
	24	69.3
78 º	72	73.3
	48	78.8
	24	79.4
LSD P>0.1		7.4

Table 2. FHB % field severity averaged across drop sizes and orifice angles on HRSW, Langdon 2007.

Drop Size	Orifice Angle F&Down	FHB % Field Severity
Fine	30º	12.8
	60º	9.0
	78 º	15.3
Medium	30º	12.5
	60º	16.4
	78 º	12.7
Coarse	30º	10.9
	60º	14.1
	78 º	11.1
LSD P>0.1		4.0

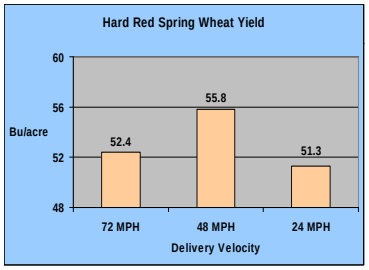

Figure 3. Yield of hard red spring wheat averaged across three air velocities, Langdon 2007.

RESULTS AND DISCUSSION

- Fungicide coverages were different among sprayer configurations on HRSW but were not apparent on barley indicating the uniqueness of architecture of the individual crop.
- Fungicide applied with a fine drop at 60º angle had the lowest incidence and field severity on the HRSW. HRSW yield was greatest when a 48 MPH air velocity was used, 55.8 vs 52.4 and 51.3 bu/acre.
- On barley less yield was measured when a coarse drop was used in combination with near vertical orientation and 24 MPH air velocity.
- Several sprayer configurations increased plump. Deoxynivalenol concentration was very different by sprayer configuration.
- The untreated control was included in the trials but was not included in the statistical calculations because it did not fit with the factorial arrangement.

Figure 4. Air velocity changes the orientation of the head improving fungicide coverage.

ACKNOWLEDGEMENT

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