

Evaluation of Extended Range Flat-Fan and Whirl-Rain Nozzles for Surface Coverage

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Selection of the right spray nozzle is one of the most important decisions to be made related to post-herbicide application. The type of nozzle determines not only the amount of spray applied, but also the uniformity of the applied spray, the coverage obtained on the sprayed surfaces, and the amount of drift that can occur. Each nozzle type has specific characteristics and capabilities and is designed for use under certain application conditions.

Peanut growers continually want to select a spray nozzle that will apply less total volume of herbicide mixtures, apply fungicides, and resist plugging. Post-herbicide applications are recommended to be applied at a total volume of 15-20 gallons per acre. When application volumes are less than label rates, there is a chance of minimal weed control or no control. Post-herbicide labels indicate that application volumes should be with a flat-fan spray nozzle when applying less than 20 gallons per acre (Syngenta Crop Protection). In years past, some peanut growers have migrated to the using of whirl-rain type nozzle for fungicide and herbicide applications. This has led to application failures.

The effectiveness of an herbicide is as good as the ability of the product to contact the weeds. This analysis measured the amount of spray coverage for extended flat-fan and whirl-rain nozzles.

Objectives

- Compare actual spray droplets and surface coverage of extended range flat-fan and whirl-rain nozzles for spraying post emergence herbicides.

Materials and Methods

A six row broadcast boom sprayer with nozzles spaced 18 inches for extended range flat-fan (figure 1) and 36 inches for the whirl-rain (figure 2) (Delavan) was used to apply Hi-Light Red spray indicator by Becker-Underwood at 10, 15, and 20 gpa with speeds of 3.5, 5.0, and 7.0 mph. Cards were placed in each row. Therefore nine replications were made for the spray droplet analysis for each nozzle evaluated. Hi-Light Red spray indicator was mixed at 32 ounces per 100 gallons of water was sprayed for the coverage and droplet size tests. Cards were allowed to dry to touch and collected. Nozzles were selected to apply liquid spray at pressures of 24 – 41 psi to achieve the desired GPA with corresponding ground speed. Table 1 lists the nozzle sizes and pressures used in the tests. Each selection was calibrated to ensure application accuracy. Figure 3 shows examples of the nozzles used in the test. Kromekote cards (figure 4) were placed in the row for collecting the spray droplets. The kromekote cards were analyzed with WRK DropletScanTM software to determine percent area covered. This software in conjunction with a flat bed scanner measures volume median diameter (VMD) of droplets

(adjusting for spread on the card), counts the number of droplets within a known area of the card, and measures percent area covered on the card by the spray.



Figure 1. Boom set-up for extended flat-fan nozzles and location of card holders.



Figure 2. Nozzle arrangement for whirl-rain nozzles.



Figure 3. Examples of the nozzles used in the tests .



Figure 4. Kromekote cards for collecting spray droplets.

Table 1. Nozzles selected, speed, spacing, and operating pressures used for the test.

Nozzle Type	MPH	GPA	Spacing	Pressure	Nozzle
Flat-Fan*	3.5	9	18	36	XR11001
	5	11	18	28	XR11002
	7	11	18	24	XR11003
Whirl-Rain**	3.5	9	36	36	WRW-2
	5	11	36	28	WRW-4
	7	10	36	29	WRW-5
Flat-Fan	3.5	15	18	30	XR11002
	5	15	18	26	XR11003
	7	15	18	29	XR11004
Whirl-Rain	3.5	15	36	28	WRW-4
	5	15	36	33	WRW-5
	7	14	36	39	WRW-6
Flat-Fan	3.5	20	18	24	XR11003
	5	19	18	25	XR11004
	7	20	18	36	XR11005
Whirl-Rain	3.5	20	36	29	WRW-5
	5	20	36	41	WRW-6
	7	20	36	29	WRW-10

*Flat-fan nozzles were Spraying Systems

**Whirl-rain nozzles were Delevan

Results and Discussion

Figures 5, 6, and 7 show representative examples of the sprayed kromekote cards at 10, 15, and 20 GPA and 3.5, 5.0, and 7.0 mph. When comparing percent area covered per kromekote card, the extended range flat-fan nozzles had the highest coverage (figures 8-10) for the application rates tested. The number of droplets per unit area (figures 11-13) had similar trends to percent area coverage except at 5 mph and 20 GPA. The VMD (microns) of the spray droplets collected on the cards (figures 14-16) showed that the extended range flat-fan nozzle had larger droplets than the whirl-rain nozzles for 10, 15, and 20 GPA.

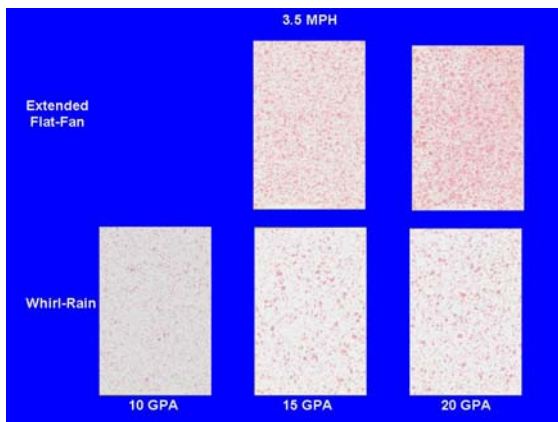


Figure 5. Examples of spray droplets collected on kromekote cards for 3.5 mph.

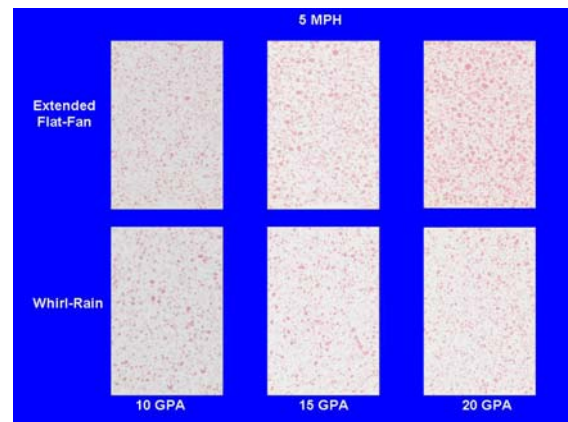


Figure 6. Examples of spray droplets collected on kromekote cards for 5.0 mph.

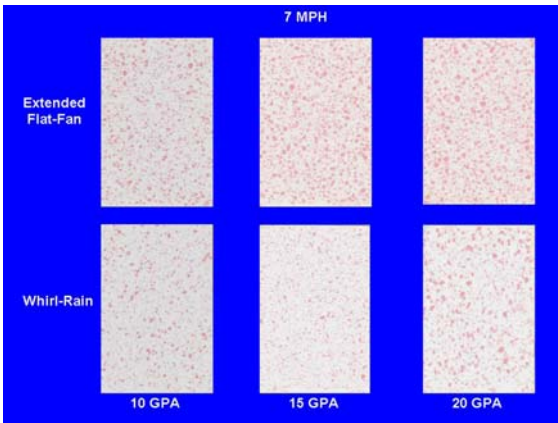


Figure 7. Examples of spray droplets collected on kromekote cards for 7.0 mph.

Comparison of Extended Flat-Fan and Whirl-Rain Nozzles, 3.5 MPH

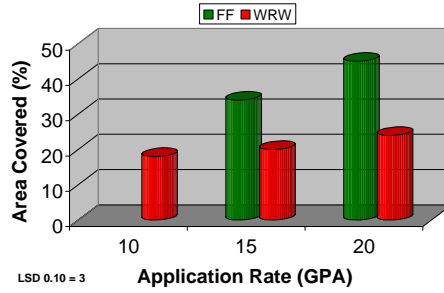


Figure 8. Percent area covered for extended range flat-fan and whirl-rain nozzles at 3.5 mph.

Comparison of Extended Flat-Fan and Whirl-Rain Nozzles, 5.0 MPH

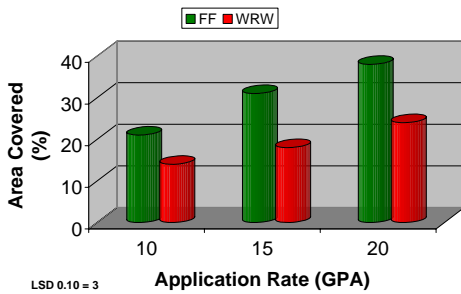


Figure 9. Percent area covered for extended range flat-fan and whirl-rain nozzles at 5.0 mph.

Comparison of Extended Flat-Fan and Whirl-Rain Nozzles, 7.0 MPH

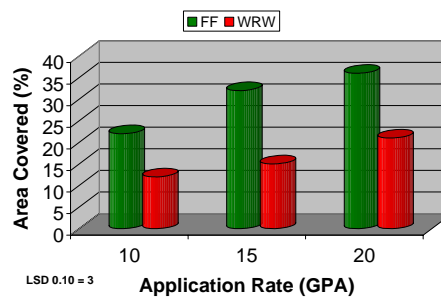


Figure 10. Percent area covered for extended range flat-fan and whirl-rain nozzles at 7.0 mph.

Comparison of Extended Flat-Fan and Whirl-Rain Nozzles, 3.5 MPH

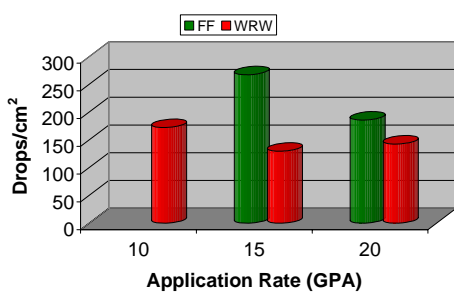


Figure 11. Number of droplets per cm^2 for extended range flat-fan and whirl-rain nozzles at 3.5 mph.

Comparison of Extended Flat-Fan and Whirl-Rain Nozzles, 5 MPH

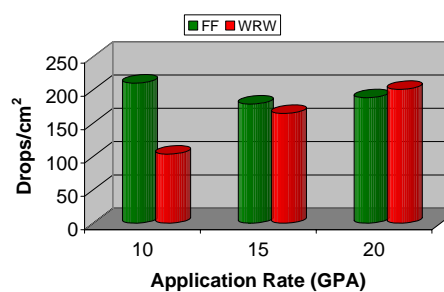


Figure 12. Number of droplets per cm^2 for extended range flat-fan and whirl-rain nozzles at 5.0 mph.

Comparison of Extended Flat-Fan and Whirl-Rain Nozzles, 7 MPH

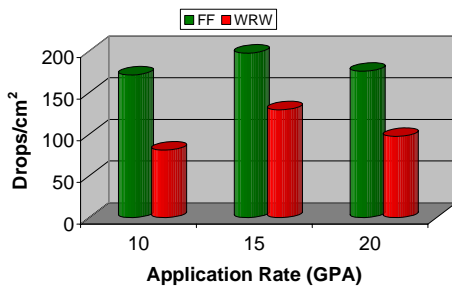


Figure 13. Number of droplets per cm² for extended range flat-fan and whirl-rain nozzles at 7.0 mph.

Comparison of Extended Flat-Fan and Whirl-Rain Nozzles, 3.5 MPH

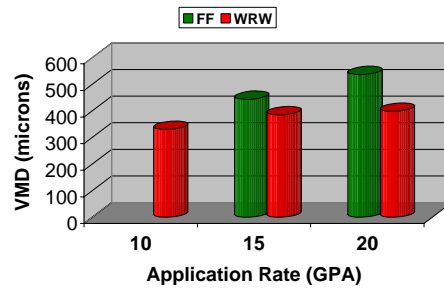


Figure 14. Comparison of volume median diameter for extended range flat-fan and whirl-rain nozzles at 3.5 mph.

Comparison of Extended Flat-Fan and Whirl-Rain Nozzles, 5.0 MPH

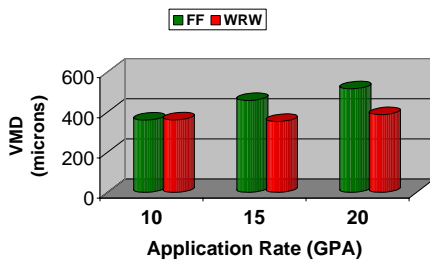


Figure 15. Comparison of volume median diameter for extended range flat-fan and whirl-rain nozzles at 5.0 mph.

Comparison of Extended Flat-Fan and Whirl-Rain Nozzles, 7.0 MPH

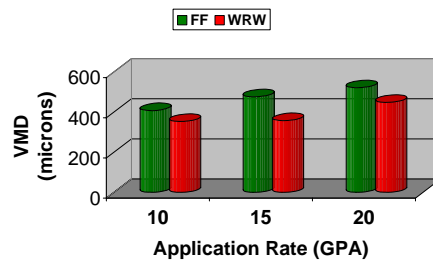


Figure 16. Comparison of volume median diameter for extended range flat-fan and whirl-rain nozzles at 7.0 mph.

Conclusion

This test shows that application rates above 15 GPA and speed less than 7 mph was acceptable for whirl-rain nozzles. The extended flat-fan nozzles had acceptable coverage up to 7 mph and 10 GPA. From this test, growers would have more weed escapes from using a whirl-rain nozzle at speeds above 7.0 mph and less than 10 GPA.