How to Spray Asparagus in Fern

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Infosheet

November 2012

Diseases such as purple spot (figure 1) can have major economic impacts for asparagus growers, and the best line of defence is spraying (see figure 2). The good news is that asparagus growers know this and take steps to protect against it. The bad news is that there are few things harder to spray than asparagus in fern.

Asparagus in fern can stand 1.5 m (5 ft) high by 1.0 m (3 ft) diameter and is typically planted on 1.2 m (4 ft) centres. Asparagus in fern has a very dense canopy full of needle-shaped leaves. This dense canopy slows air movement, making conditions still, humid and very difficult for a spray droplet to penetrate.

Spray coverage is a combination of two factors: the area of the target contacted by spray droplets, and the distribution of spray droplets over that target. In order to show coverage, we used water-sensitive paper, which is yellow until contact with spray turns it blue. Three sets of three targets were placed in approximately the same location for each pass (see Figure 3).

Figure 1: Asparagus infected with Purple Spot

We tested five popular nozzle types, at two ground speeds using three carrier volumes to answer three questions:

1. Does spray volume impact spray coverage?
2. Which nozzle style gives the best coverage?
3. Does travel speed impact spray coverage?

Figure 2: Self-propelled, front-mounted boom sprayer in asparagus in fern

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1. Does spray volume impact spray coverage?

Five different nozzle types were used to spray three volumes onto the targets at 16 kph (10 mph). This was repeated three times and target coverage was determined both as droplet deposits per cm² (see Figure 4) and total % covered (see Figure 5).

Cards in each position consistently received a significantly higher average deposit per cm² and significantly higher average percent coverage at higher spray volumes. The relatively low coverage in the middle position was anticipated given the challenging orientation of the targets to the sprayer.

Therefore, it would appear higher volumes result in better coverage, at least up to 280 L/ha (30 gpa).

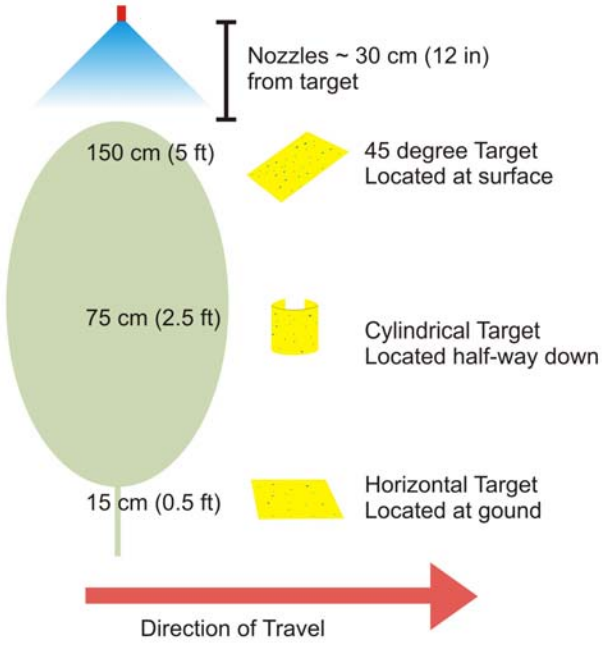

Figure 3: Layout of water-sensitive paper targets relative to asparagus fern, sprayer and sprayer direction of travel.

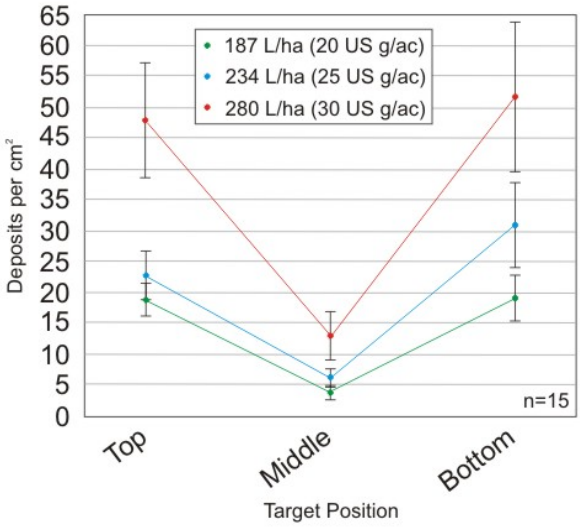

Figure 4: Combined average deposits per cm² for five different nozzle types at 187 L/ha (20 US g/ac), 234 L/ha (25 US g/ac) and 280 L/ha (30 US g/ac) at a ground speed of 16 kph (10 mph). Bars represent standard error.

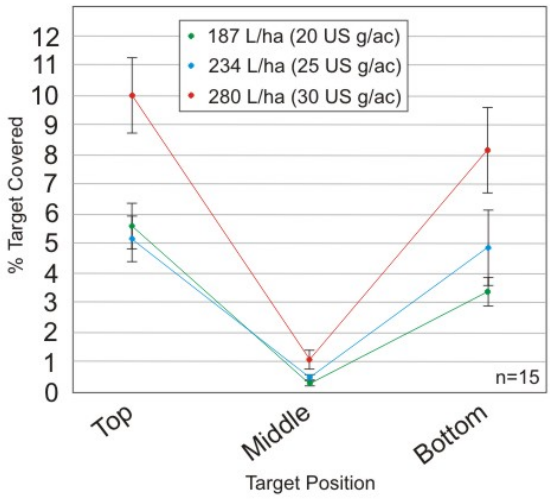

Figure 5: Combined average percent coverage for five different nozzle types at 187 L/ha (20 US g/ac), 234 L/ha (25 US g/ac) and 280 L/ha (30 US g/ac) at a ground speed of 16 kph (10 mph). Bars represent standard error.

2. Which nozzle style gives the best coverage?

Coverage from five different nozzles was compared: the Hollow cone, Flat fan, Dual flat fan, Guardian Air and Air-induced hollow cone. Given that higher volumes result in better coverage, the following figures illustrate droplet deposits per cm² (see Figure 6) and total % covered (see Figure 7) at 280 L/ha (30 gpa).

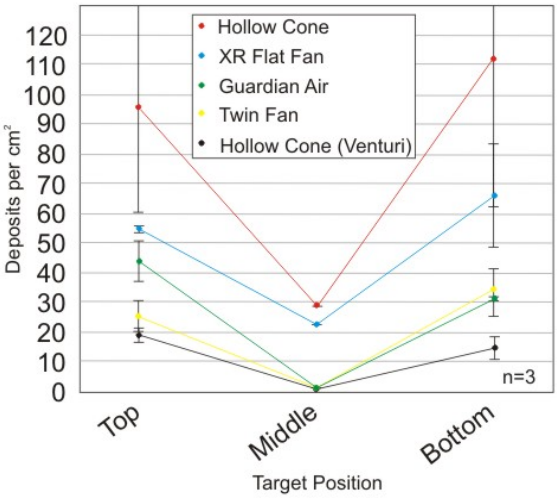

Figure 6: Average deposits per cm² for five different nozzle types at 280 L/ha (30 US g/ac) and 16 kph (10 mph). Bars represent standard error.

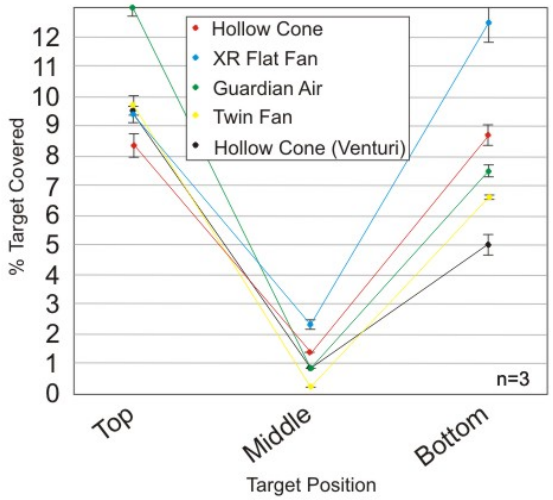

Figure 7: Average percent coverage for five different nozzle types at 280 L/ha (30 US g/ac) and 16 kph (10 mph). Bars represent standard error.

Each nozzle followed a similar trend with more droplets at the top of the canopy, less or par at the bottom of the canopy, and considerably less in the middle of the canopy given the challenging orientation of the target.

The trend in droplet density from highest to least coverage is:

1. Hollow Cone
2. XR flat Fan
3. Guardian Air
4. Dual Flat Fan
5. Air Induced Hollow Cone.

The percent coverage data was less clear. The top two nozzles for each position were:
Top Target:

1. Guardian Air
2. All other nozzles approximately the same

Middle Target (Stem):

1. XR flat Fan
2. Hollow Cone

Bottom Target:

1. XR flat Fan
2. Hollow Cone

It can be argued that the target at the top of the canopy is easiest to spray, and does not have as much importance as the middle and bottom targets. As such, it would appear that the XR flat fan and Hollow cone nozzles give the best overall coverage. It is debatable whether the higher droplet count from the Hollow cone is more important than the higher percent coverage of the XR flat fan.

3. Does travel speed impact spray coverage?

Hollow cone nozzles and XR flat fan nozzles were used to spray targets at two travel speeds and three volumes. Target coverage was determined both as droplet deposits per cm² (see Figure 8) and total % covered (see Figure 9).

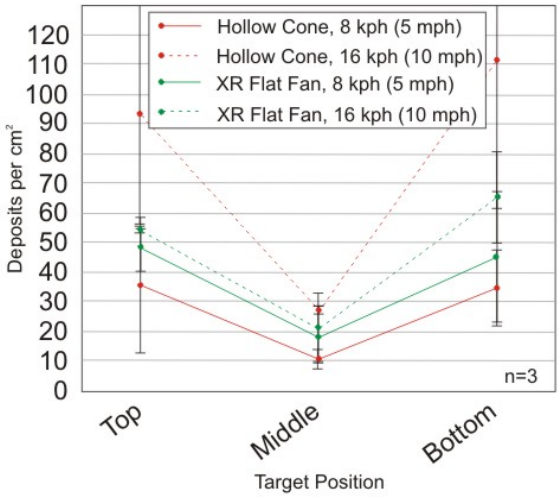

Figure 8: Average deposits per cm² for Hollow cone and XR flat fan nozzles at 280 L/ha (20 US g/ac) and either 8 kph (5 mph) or 16 kph (10mph). Bars represent standard error.

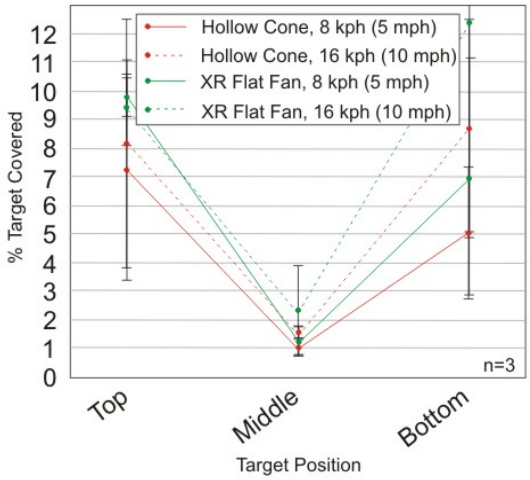

Figure 9: Average percent coverage for Hollow cone and XR Flat fan nozzles at 280 L/ha (30 US g/ac) and either 8 kph (5 mph) or 16 kph (10 mph). Bars represent standard error.

The variability in deposit density and percent coverage from medium/fine droplets created by the hollow cone nozzles make it difficult to determine statistical significance, but the trend suggests that higher ground speeds improve coverage in the middle and bottom of the canopy. This is likely due to the wake of the sprayer and the vortices created by its passage stirring fine droplets into the canopy.

Overall recommendations:

The data suggest that coverage is improved when the sprayer travels at 16 kph (10 mph) rather than 8 kph (5 mph). Coverage is also improved at higher spray volumes, where 280 L/ha (30 US g/ac) provided the best overall coverage for all nozzles. As for the best nozzle, this depends on the application; the hollow cone created higher droplet densities than the XR flat fan, but the XR Flat fan created higher percent coverage. Higher droplet densities may be preferred when controlling disease with contact products, but spray drift may become a concern. Higher percent coverage might be preferred with locally systemic products where complete coverage is less of a concern and preventing spray drift is a priority.

Acknowledgments:

Special thanks to Max Underhill Farm Supply (Vienna, Ontario) for use of the sprayer and their assistance, Mr. Ken Wall of Sandy Shore Farms Ltd. (Port Burwell, Ontario) for providing the site and hosting the associated workshop and to TeeJet Technologies for their donation of parts and supplies.

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