DECLINE OF NEW VINEYARDS IN SOUTHERN SPAIN

ASSESSING AND OPTIMIZING SPRAYER TECHNOLOGIES IN COMMERCIAL EASTERN WASHINGTON STATE WINE GRAPE VINEYARDS

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Abstract:

Context and purpose of the study - In-season vineyard pest management relies on proper timing, selection, and application of products. Most of the research on pest management tends to focus on the influence of regional conditions on these aspects, with an emphasis on product timing and efficacy evaluation. One aspect that is not fully vetted in various vineyard regions is application (sprayer) technology. The purpose of this study was to determine the influence of regional conditions on sprayer performance in commercial wine grape vineyards in eastern Washington.

Material and methods – Three commercially available sprayer technologies were optimized and assessed in the 2016 and 2017 production seasons. The sprayer technologies evaluated were: multi-fan heads, pneumatic, and electrostatic. Data were collected in commercial *Vitis vinifera* wine grape vineyards at two growth stages, 50% bloom and pea sized berries using a fluorescent tracer (Pyranine) to track deposition within the vineyard. Aspects of the sprayers that were evaluated were spray deposition patterns in the canopy and in-field drift (aerial and vineyard floor). Sprayer deposition was collected on 5cm x 5cm plastic cards. These cards were placed in 5 canopy zones (upper sides, upper middle, and both sides of fruit zone), on the vineyard floor in the first 3 rows downwind from the sprayer, and on aerial poles collecting drift in 0.3-meter increments above the canopy for 0.9-meters in the first 3 rows downwind from the sprayer. Sprayer data collected in the vineyard was used to evaluate total spray deposition of each sprayer.

Results - All sprayer technologies showed consistent in-canopy deposition and drift patterns at both canopy growth stages. The greatest deposition found in the canopy; the Quantum Mist had 95.57% and 98.48%, the Gregorie had 97.35% and 97.08%, and the On Target had 91.79% and 80.12% of total spray deposited in the canopy at the 50% bloom and pea-sized berry growth stages, respectively. Aerial and floor drift was relatively minimal with these technologies. The Quantum Mist had aerial drift of 1.65% and 0.01%, and floor drift of 2.78% and 1.51% for the two growth stages, respectively. The Gregoire had aerial drift of 0.09% and 0.08%, and floor drift of 2.56% and 2.84% for the two growth stages, respectively. The On Target had aerial drift of 0.42% and 4.05%, and floor drift of 7.79% and 15.83% for the two growth stages, respectively. Aerial and floor drift were highest in the row closest to spray application, indicating that longer-distance drift is relatively low with modern spray technologies. Ultimately, the information generated from this project will be used to help optimize sprayer selection for different vineyard sites.

Keywords: Sprayer, drift, deposition, Pyranine, fluorescent, optimization

1. Introduction.

Viticulture and Enology Program
Washington State University

Assessing and Optimizing Sprayer Technologies in Commercial Eastern Washington State Wine Grape Vineyards

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Principle

Research on pest management tends to focus on the influence of regional environmental conditions, with an emphasis on evaluation of product timing and efficacy. Selecting a sprayer that is appropriate for a given vineyard can be just as important as initial site selection; sprayer choice can influence the effectiveness of a pest management program. In addition, differences in vineyard macroclimate and trellising/training can also influence how a sprayer practically operates.

Figure 1. *Left* – Tracer is added to the sprayer tank for vineyard application. *Left Center* - Tracer was collected from multiple zones in the canopy. *Right Center* - Aerial drift deposition was also collected. *Right* - Drift onto the vineyard floor was collected both for analysis (plastic cards), and for visual comparison (yellow water-sensitive paper).

Methods

Data were collected in commercial *Vitis vinifera* wine grape vineyards at two growth stages, 50% bloom (early season) and pea sized berries (late season) using a fluorescent tracer (Pyranine) to track spray deposition within the vineyard (**Fig. 1**).

Sprayer deposition was collected on 5cm x 5cm plastic cards. Aspects of the sprayers that were evaluated included spray deposition patterns of: 1) five zones of the canopy (upper sides, upper middle, and both sides of fruit area); 2) aerial poles collecting drift in 0.3-meter increments above the canopy for 0.9-meters in the first 3 rows downwind from the sprayer; and 3) vineyard floor in the first 3 rows downwind from the sprayer following the half row being sprayed (**Fig. 1**). The individual sprayer liters per hectare were normalized for the sprayer over the growing season.

Quantum Mist

Figure 2. The commercial Chardonnay vineyard used for the Quantum Mist was located in the Horse Heaven Hills AVA of Washington.

Table 1. Distribution of tracer, as a percentage of total, in each area of the vineyard.

Quantum Mist		
Modified VSP	**Early Season**	**Late Season**
Canopy	95.57%	98.48%
Floor	2.78%	1.51%
Aerial	1.65%	0.01%

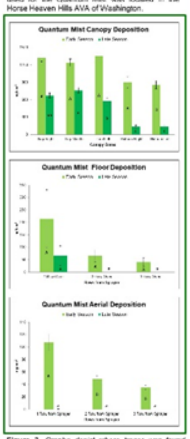

Figure 3. *Graphs depict where tracer was found within different areas of the vineyard as indicated in Table 1. Letter's denote significant differences between means using Tukey's HSD at α= 0.05. Uppercase letters denote within early season spray timing, lowercase denote within late season.*
Top - Canopy deposition of tracer in early and late season. *Middle* – Aerial drift deposition of tracer in early and late season. *Bottom* - Floor drift deposition of tracer in early and late season.

Canopy Deposition

More spray deposition was collected in the early season as compared to late season (**Fig. 3, top**). Within each spray application timing, the zones at the top of the canopy had significantly more deposition than the fruit zones (*$p<0.0001$ for both*).

Floor Deposition (Drift)

As expected, more drift was collected in the row closest to the sprayer (**Fig. 3, center**), regardless of timing of spray. However, there was no significant difference between rows (*$p=0.07$ early season, $p=0.09$ late season*).

Aerial Deposition (Drift)

In the early season, significantly more aerial drift was collected in the row closest to the sprayer (*$p=0.003$*), compared to the rows further away from the sprayer (**Fig. 3, bottom**). By late season, there was lower overall aerial drift, and no significant difference between rows (*$p=0.5$*).

Gregoire

Figure 4. The commercial Chardonnay vineyard used for the Gregoire sprayer was located in the Horse Heaven Hills AVA of Washington.

Table 2. Distribution of tracer, as a percentage of total, in each area of the vineyard.

Gregoire		
Modified VSP	**Early Season**	**Late Season**
Canopy	97.35%	97.08%
Floor	2.56%	2.84%
Aerial	0.09%	0.08%

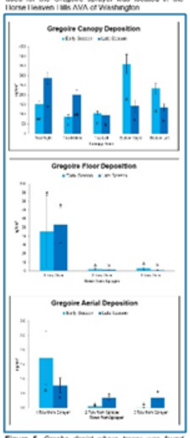

Figure 5. *Graphs depict where tracer was found within different areas of the vineyard as indicated in Table 1. Letter's denote significant differences between means using Tukey's HSD at α= 0.05. Uppercase letters denote within early season spray timing, lowercase denote within late season.*
Top - Canopy deposition of tracer in early and late season. *Middle* – Aerial drift deposition of tracer in early and late season. *Bottom* - Floor drift deposition of tracer in early and late season.

Canopy Deposition

Early season spray deposition had significantly higher amounts in the fruiting zone (*$p<0.0001$*) compared to the upper canopy (**Fig. 5, top**), and was opposite in the late season spray (*$p=0.0005$*).

Floor Deposition (Drift)

Floor drift was highest in the row closest to the sprayer (**Fig. 5, center**), regardless of timing of spray application. There was a significant difference in drift between rows from the sprayer in the late season spray application timing (*$p=0.01$*), but not the early season (*$p=0.6$*).

Aerial Deposition (Drift)

More aerial drift was collected in the row closest to the sprayer (**Fig. 5, bottom**), but no significance between rows (*$p=0.4$ early season, $p=0.5$ late season*). The late season spray application timing had higher spray deposition in rows further from the sprayer, likely due to weather influence.

On Target

Figure 6. The commercial Riesling vineyard used for the On Target sprayer was located in the Columbia Valley AVA of Washington.

Table 3. Distribution of tracer, as a percentage of total, in each area of the vineyard.

On Target		
Strict VSP	**Early Season**	**Late Season**
Canopy	91.79%	80.12%
Floor	7.79%	15.83%
Aerial	0.42%	4.05%

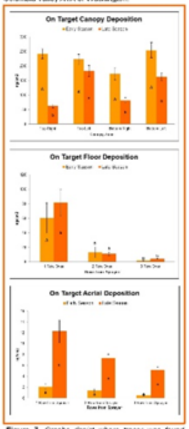

Figure 7. *Graphs depict where tracer was found within different areas of the vineyard as indicated in Table 1. Letter's denote significant differences between means using Tukey's HSD at α= 0.05. Uppercase letters denote within early season spray timing, lowercase denote within late season.*
Top - Canopy deposition of tracer in early and late season. *Middle* – Aerial drift deposition of tracer in early and late season. *Bottom* - Floor drift deposition of tracer in early and late season.

Canopy Deposition

Early season spray deposition was relatively even across all zones (*$p=0.1$*). The late season deposition had a clear division between right and left side of the canopy (**Fig. 7, top**), which is likely due to sprayer technology, not the canopy (*$p<0.0001$*).

Floor Deposition (Drift)

As expected, more floor drift was collected in the row closest to the sprayer (**Fig. 7, center**), and there was a significant difference in drift between rows from the sprayer (*$p=0.01$ early season, $p=0.0002$ late season*) regardless of spray application timing.

Aerial Deposition (Drift)

More aerial drift was collected in the row closest to the sprayer (**Fig. 7, bottom**), but deposition between rows was not significant (*$p=0.2$ early season, $p=0.06$ late season*). Higher deposition in the late season may be influenced by weather conditions, leading to increased drift tendencies.

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