Droplet size and deposition of glyphosate and 2,4-D drift in a wind tunnel

Matthew R. Nelson, Bruno C. Vieira, Annah M. Geyer, Greg R. Kruger
University of Nebraska-Lincoln, West Central Research and Extension Center

Introduction

- Particle drift, or the physical movement of spray particles, is dependent on factors such as wind speed, boom height, distance from susceptible vegetation, and spray particle size
- Spray particle size is affected by nozzle type, operating pressure, orifice size, and tank solution
- Wind speed, wind direction, and location of susceptible vegetation are more difficult or impossible to control
- Small droplets exit nozzles with a lower velocity and thus hang in the air for a longer period of time than large droplets, increasing their potential to move off-target
- In general, increasing downward droplet velocity decreases drift potential
- Droplet movement is complex process. Therefore it is important that all factors affecting spray particle movement are carefully monitored

Objective

- The objective of this study was to determine the deposition and droplet size of spray particle drift resulting from an application of glyphosate and 2,4-D.

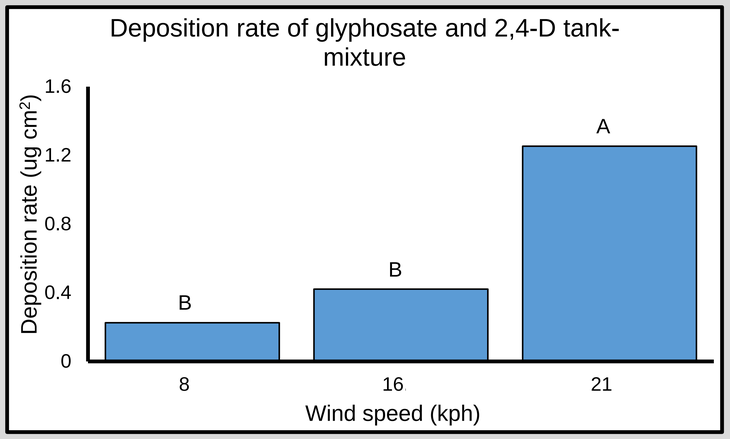
Materials and Methods

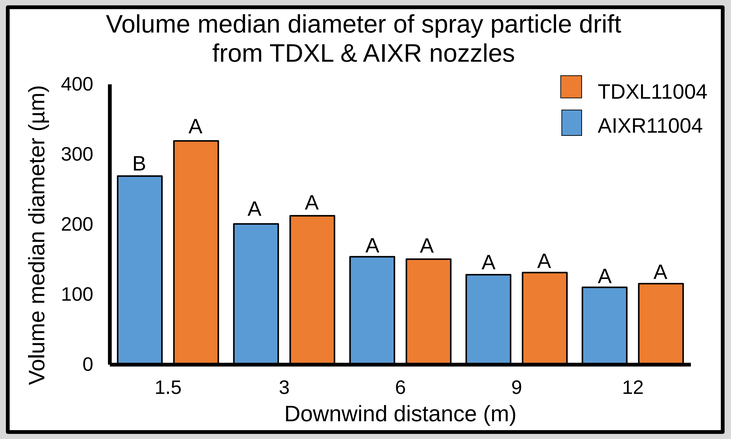
- A wind tunnel drift study was conducted in 2016 at the Pesticide Application Technology Laboratory
- Experiment Design: randomized complete 2x3x5 factorial design with six replications
- Enlist Duo™ herbicide, a tank-mixture of glyphosate and 2,4-D, was applied through 11004 flat-fan nozzles at 276 kPa
- Selected nozzles: Air-Induction Extended Range (AIXR) and TurboDrop XL (TDXL)
- Selected wind speeds: 8, 16, and 21 kph
- Rate: 592 g a.e. ha^{-1} glyphosate and 558 g a.e. ha^{-1} 2,4-D Carrier volume: 140 l ha^{-1}
- Fluorescent tracer dye (PTSA) added at 0.6 µg ml^{-1}
- Mylar cards used to collect drift deposition rate ($\mu g\ cm^2$)
- Water sensitive cards used to volume median diameter (μm)
- PROC GLIMMIX in SAS 9.4 used to conduct multiple comparison ANOVA analysis
  - Columns with same letter not statistically different at α = 0.05

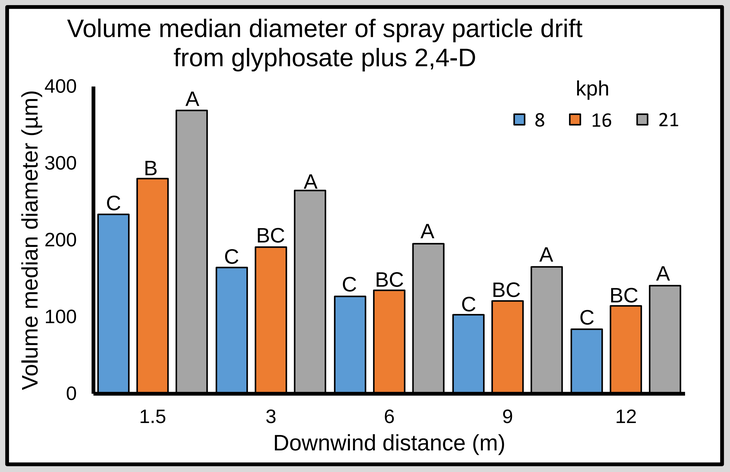
Figure 1. AIXR11004 and TDXL11004 nozzles

Figure 2. Collector setup in low-speed wind tunnel

Results







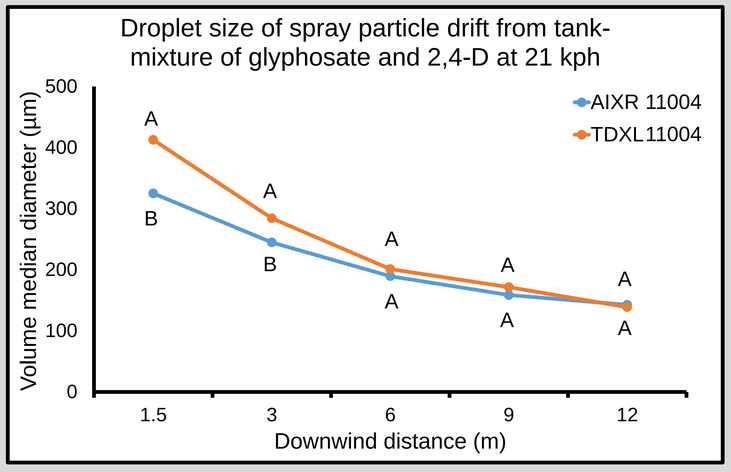


Figure 3. AIXR at 8 kph at different distances downwind (m)

Figure 4. AIXR at 16 kph at different distances downwind (m)

Figure 5. AIXR at 21 kph at different distances downwind (m)

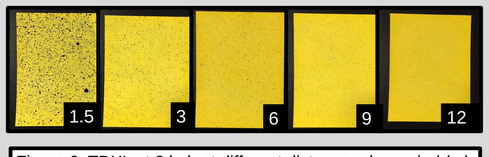


Figure 6. TDXL at 8 kph at different distances downwind (m)

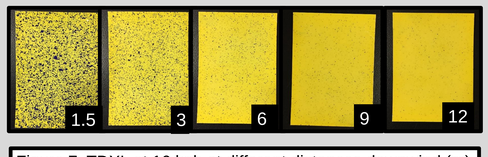


Figure 7. TDXL at 16 kph at different distances downwind (m)

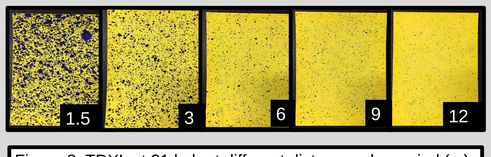


Figure 8. TDXL at 21 kph at different distances downwind (m)

Conclusions

- Deposition and droplet size of the spray particle drift resulting from the application of a glyphosate and 2,4-D solution was influenced by wind speed, as higher wind speed resulted in more deposition and larger droplets moving off-target.
- Spraying glyphosate plus 2,4-D through the TDXL11004 nozzle at a high wind speed (21 kph) resulted in the collection of larger spray droplets at downwind distances (1.5 and 3 m) than the AIXR11004.
- While droplet size does impact the drift potential of a herbicide application, wind speed is still the most important factor, as even large spray droplets can move off-target.
- Factors besides spray droplet size must be considered when selecting low drift/air inclusion nozzles.