Working to Achieve Drift Control for Emerging Dicamba Technologies

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Abstract:

The introduction of new dicamba technologies present a great opportunity for growers across our nation. It also poses a great threat to non-tolerant crops. Finding the correct drift retardant and nozzle type will be a key player in how widely accepted the increased use of dicamba technologies will be. Comparisons of drift retardants and nozzle types will be done both in field trials and a wind tunnel. The primary goals of this research is to maximize drift reduction to protect non-tolerant crops and improve efficacy on the spray target.

Introduction:

Extensive research will be needed to deliver satisfactory agricultural practices that society demands (Hoffmann, et al., 2009). Emerging dicamba technologies in particular will present very serious issues, as its use is expected to dramatically increase. Two issues of major concern is off-target movement and volatilization of spray particles (Johnson, et al., 2012). As little as 0.56 g acid equivalent/ha of dicamba herbicides can be detected 21 m from the edge of a treated area which is enough to have a significant impact on non-tolerant seedlings (Egan, Mortensen 2011). The objective of our study was to determine the best drift retardant and spray nozzle to use in order to reduce off-target movement.

Materials & Methods:

Distance of drift was measured in a wheat field in boot stage. Treatments included experimental drift retardants and currently used drift retardants (Figure 1). The plots measured 3 m x 18 m and each treatment was then replicated 4 times using the same dimensions. A CO_2 propelled backpack sprayer with a 1.8 m, 6 nozzle boom that was pressurized to 345 kPa was calibrated to spray 93 $L \cdot ha^{-1}$ at 4 mph ground speed. Wind speed was constantly tracked and recorded to ensure that while spraying wind speed stayed within the bounds of 6 and 13 mph. All treatments were mixed with glyphosate (Roundup Powermax®) at 2,336 $ml \cdot ha^{-1}$ and a water conditioner (Class Act®) at 2.5% v/v. The same solutions were mixed for nozzle comparisons along with a second treatment that included drift retardant (Interlock®) at 292 $ml \cdot ha^{-1}$. Drift distance (m) was measured from the center of the boom to the end of affected wheat 13 days after application. A wind tunnel was also used to measure the percent of particles < 105 µm diameter in each treatment applied in the field. This was done to determine the percent of particles susceptible to drift and volatilization.

Statistical analysis: Data were analyzed using R 3.1.1. (R Foundation for Statistical Computing, Vienna, Austria). Mean comparisons were determined using Tukey's HSD ($p<0.05$). Correlations were obtained using the correlation program in R 3.1.1.

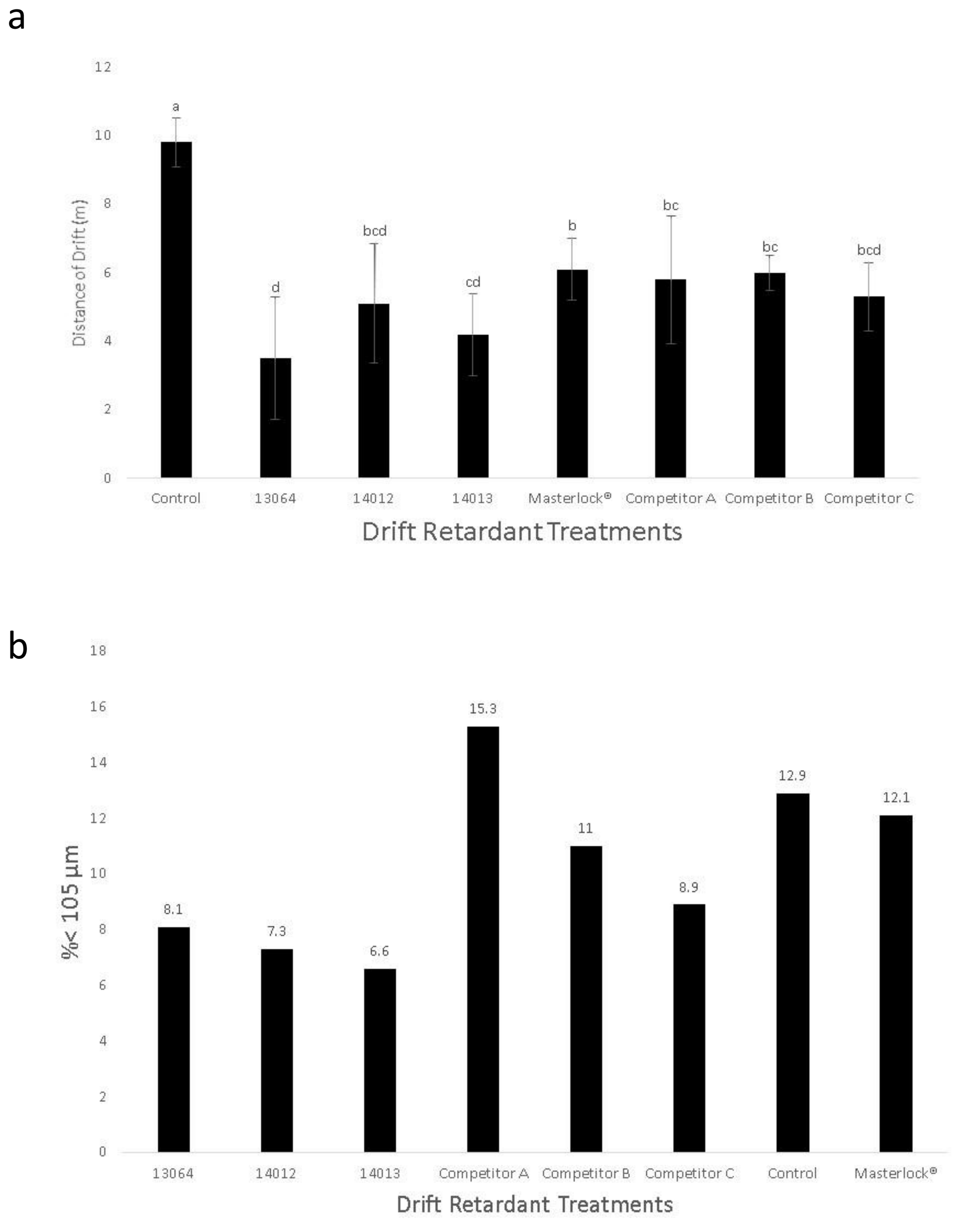

Figure 1. Drift retardants effect on drift reduction in field and wind tunnel tests. a) Comparisons, standard error, and Tukey's HSD of field data. b) Drift retardant effect on percent of particles < 105 µm diameter.

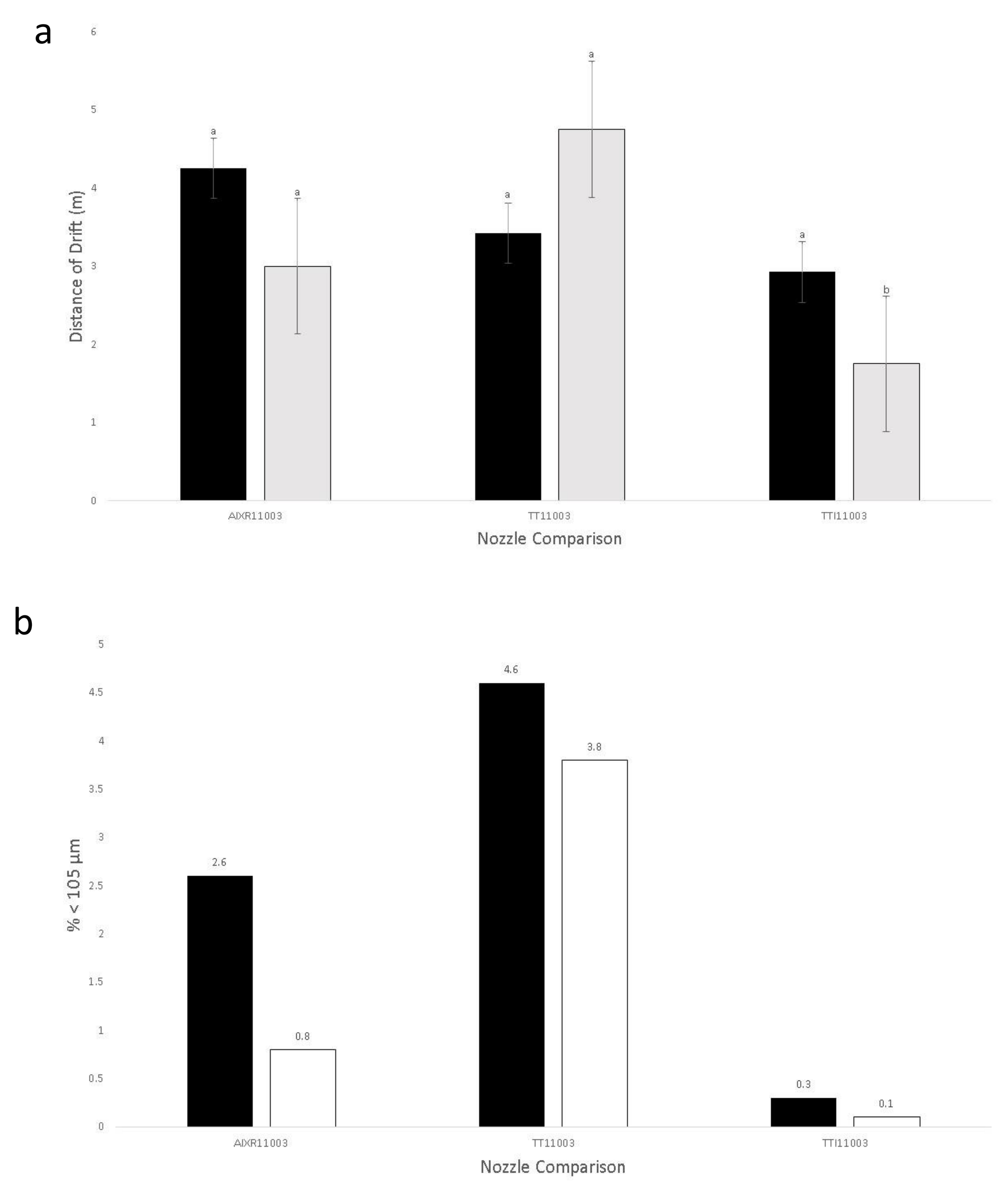

Figure 2. Spray nozzle effect on drift reduction in field and wind tunnel tests. a) Comparisons, standard error, and Tukey's HSD of field data. b) Spray nozzle effects on percent of particles < 105 µm diameter.

Results & Discussion:

Although all drift retardants had a positive effect on drift reduction in the field trials, 13064 in particular had a significant reduction of drift with 64% less drift than the control. In fact, 13064 had 30% less drift than Competitor C, the top performer (Figure 1a). Although, 13064 did not produce the least amount of particles < 105 µm in the wind tunnel tests it did compare very well overall with a 37% reduction over the control (Figure 1b). When Interlock® was added, TTI11003 reduced drift significantly over the next best performing nozzle, AIXR11003. When nozzles were compared without Interlock®, TTI11003 still significantly outperformed AIXR11003 (Figure 2a). In wind tunnel tests TTI11003 again showed an advantage with 88% reduction in particles < 105 µm over AIXR11003 (Figure 2b). Correlation between wind tunnel and field data proved to be very strong and significant with r=0.81. It is very important to know if wind tunnel data can be confidently used to replace field tests. With wind tunnel tests potentially replacing field tests dramatic savings on efficiency and cost can be expected in future studies. (Fritz, et al., 2012)

Figure. 3 The % of particles < 105 µm in diameter were measured in a wind tunnel.

Conclusions:

- Drift retardant 13064 reduced drift at a significantly higher rate than all other drift retardants.
- TTI11003 had a significant effect on drift when Interlock® was used in spray solution.
- Wind tunnel data can be confidently used to replace field trials.

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