Introduction

Applicators use a wide variety of nozzle to make pesticide applications today. There are many different types of venturi nozzles used and applicators are often concerned about the spray pattern, droplet size distribution and overall effectiveness of venturi nozzle when spraying in dusty conditions or other situations where the air induction ports could become plugged. These type of nozzles produce larger droplets. Part of what is believed to cause this effect is inducing air into the liquid inside of the nozzle body.

Objective

Evaluate the droplet size distribution of five venturi nozzles and the effect of plugged air inclusion ports.

Material & Methods

- Completely randomized factorial design
- Conducted using a low-speed wind tunnel at the Pesticide Application Technology Lab
- Water sprayed at 276 kPa with three replicates.
- Five venturi nozzles (Figure 2).

![Droplet measurement setup](http://www.sprayerdepot.com/)

**Figure 1.** Illustration of the low speed wind tunnel and laser diffraction system used for droplet spectrum analysis. (Courtesy from Thomas R. Butts)

**Figure 2.** Five venturi nozzles used to evaluate droplet size from plugged air induction ports.

Each nozzle was tested

- air inclusion ports open,
- one port plugged,
- two ports plugged

**Volumetric droplet size spectra parameters used**: $D_{10}$, $D_{50}$, $D_{90}$, Relative Span ($RS$) *, and Percentage of fine droplets ≤ 150 µm.

* $RS = \frac{D_{90} - D_{10}}{D_{50}}$

Data were subjected to ANOVA using the PROC GLIMIX procedure in SAS v 9.4 and means were separated at $P = 0.05$ using Fisher’s protected LSD test and the Tukey adjustment.

Results & Discussion

**Figure 3.** Comparison of the $D_{50}$ for five venturi nozzles using the 04 (A) and 06 orifice (B) with no plugged ports, one plugged port and two plugged ports.

**Figure 4.** Comparison of the Relative Span (RS) for five venturi nozzles using the 04 (A) and 06 orifice (B) with no plugged ports, one plugged port and two plugged ports.

**Figure 5.** Comparison of the percentage of droplets ≤ 150 µm for five venturi nozzles using the 04 (A) and 06 orifice (B) with no plugged ports, one plugged port and two plugged ports.

- A nozzle*plugged port*orifice size interaction was significant for the $D_{50}$ and RS ($p<0.0001$); however a similar pattern emerged across orifice sizes.

- TTI nozzle plugged $\rightarrow$ the $D_{50}$ increased by 6.5% and 4.3%, for the 04 and 06 orifice sizes, respectively. AI and TDXL nozzles two ports were plugged $\rightarrow$ the $D_{50}$ decreased by 15.0 and 13.9% for the 04 orifice sizes, and 13.5 and 12.6% for the orifice 06, respectively.

- TDXL and AI nozzles $\rightarrow$ for the orifice 04 produced more percentage droplets ≤ 150 µm with two ports plugged, AIXR $\rightarrow$ produced more with air inclusion ports open plugged

Conclusion

Different nozzles will perform differently when the air induction ports plug. Because there is not clear trend as to how nozzles will perform, it is recommended that applicators try to keep nozzles clean and air induction ports unobstructed as much as possible.