Air Induction Nozzles

A Canadian Experience in Industry Adoption

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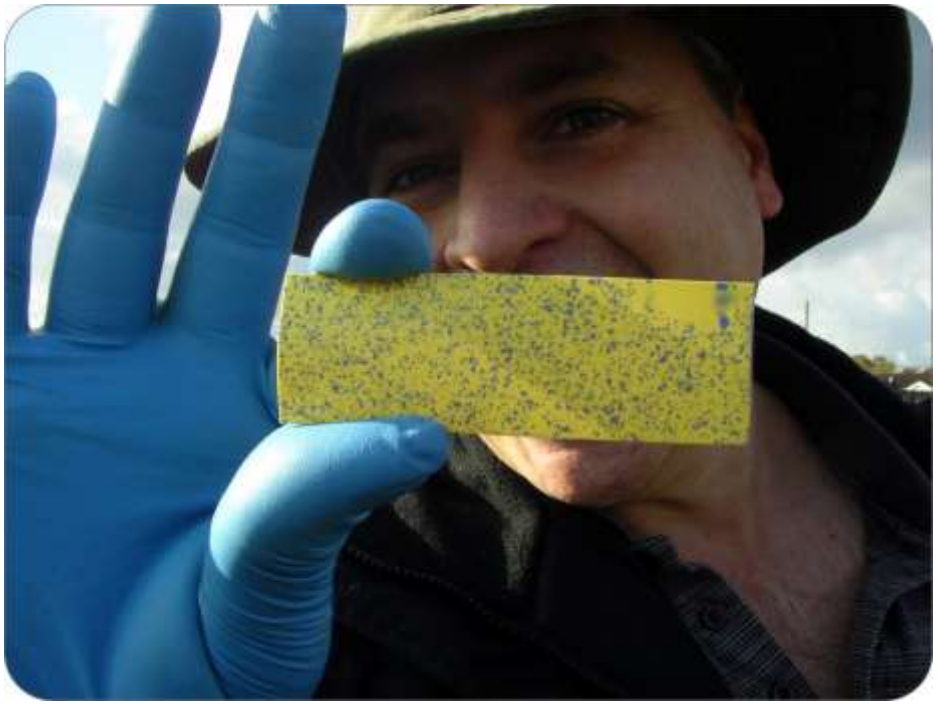
About Me

- Too many years in university as a student of plant cell physiology
- Five years as a consultant for companies that designed colleges and universities
- Ontario Ministry of Agriculture's Application Tech Specialist (aka Spray Guy) since 2008



Pesticide Drift 101

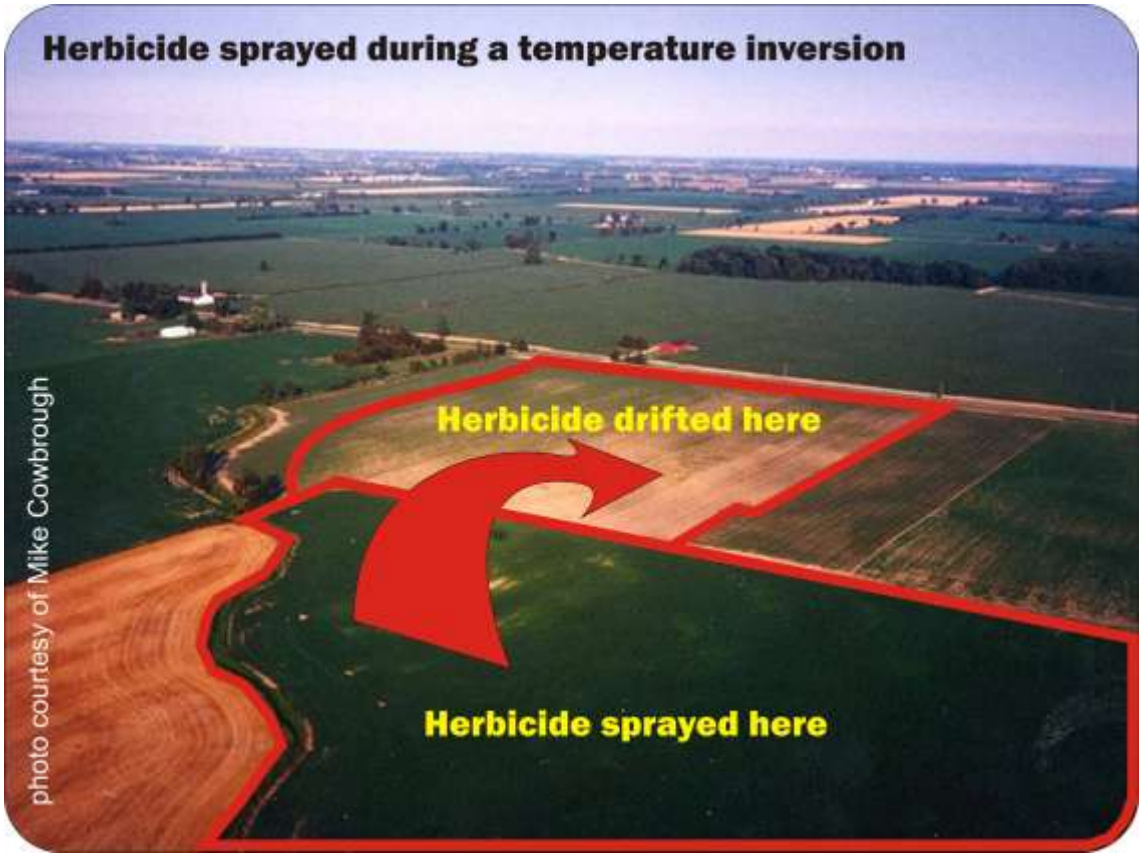
- **Particle drift** is the movement of pesticide droplets, or solid particles, outside the area being treated – on a scale of tens-of-metres.

- **Vapour drift** is the movement of pesticide vapours outside the area being treated – on a scale of kilometres.

Prevent Spray Drift!
Watch our new video series at:
ontario.ca/spraydrift

What can Pesticide Drift do?

- **Pesticide drift can damage nearby natural habitats and/or crops, like this newly planted tomato field damaged by glyphosate from soybean. For multiyear crops, like grapes, the damage can last for years.**

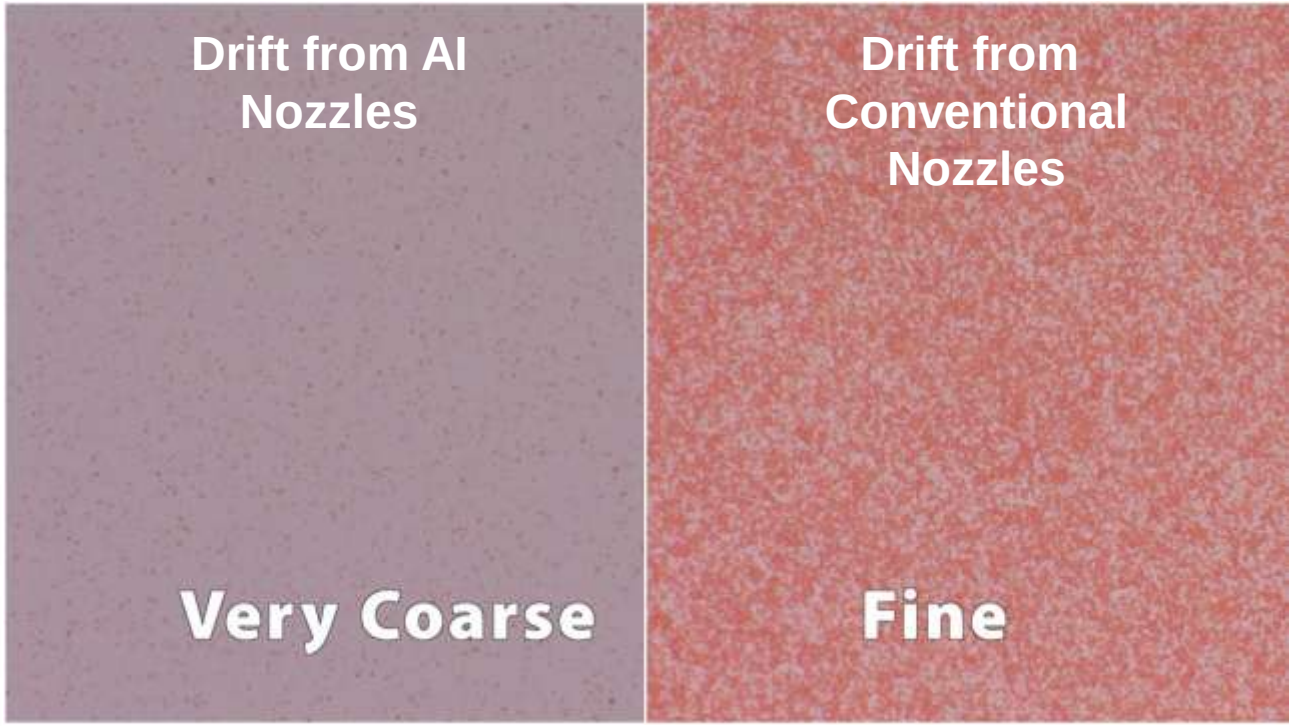


What can Pesticide Drift do?

- **When pesticide drift warrants legal action, it often has a big monetary penalty and can destroy neighborly relations.**

To Reduce Drift, Use Large Droplets

- **Small droplets are prone to drift and large droplets are not. A nozzle that only makes large droplets should mitigate particle drift.**



Red dye sprayed upwind of white targets 5 m (16 ft) downwind at 10 km/h (6 mph)

None of this is a Revelation

- **We've known most of this for more than fifty years…**

Foamjet Nozzles – 1950s

- That's why in the 1950's agrichemical and farm equipment companies wanted to mitigate the drift of products like Banvel and 2,4-D.

- They tried to adopt an industrial nozzle into farm production. This nozzle was a **foamjet nozzle** that incorporated air into the spray mixture to create a foamy, no-drift output.

- The spray quality was really bad, and so was weed control, so conventional flatfans remained standard.

Low Pressure Nozzles – 1970s & 80s

- So, air induction was shelved. In the early 1970's, TeeJet released it's low pressure (LP) extended range conventional flat fan.

- The concept was simple – high pressure creates smaller, drift-prone droplets, so low pressure makes larger, no-drift droplets.

- The tip used a large pressure-reducing chamber and an elliptical outlet at 90º to the inlet. In the mid 1980's it was replaced by the more marketable Extended Range (XR) tip, which was ISO colour coded and could operate at 40 psi.

From Hofman, N. Dakota State, 2003

Pre-Orifice Nozzles – Early 1990s

- **In the early 90's, we saw nozzles with metering pre-orifices that reduced pressure and used turbulence to make large droplets. Turbo TeeJet is a good example.**

- **Now growers could use higher pressures of 40 or 50 psi, which were native to their sprayers, and the nozzle would automatically reduce the pressure by roughly half.**

From Hofman, N. Dakota State, 2003

The Return of the AI – Late 1990s

- **Would you accept a nozzle from this man?**

The Story Kept Changing

- **Now bear this in mind - Growers have long memories and by now they'd been told:**

  - AI nozzles (the failed foamers) don't work.
  - Low pressure makes big droplets.
  - Use 15 psi on your boom.
  - Use 40 psi on your boom.
  - Use 50 psi on your boom.

- **Now they've been given a nozzle three times as long as a pre-orifice flat fan, and told to spray up to 100 psi to reduce drift. …wow.**

From Hofman, N. Dakota State, 2003

Reported Problems with AI

- **Not surprisingly, growers started reporting problems:**

  - **"My sprayer won't produce pressures that high"**
  - **"My nozzles snag on everything and break"**
  - **"The air intake on nozzles behind the wheels plug with dirt / fungicide / weed seeds"**
  - **"Rate controller collapsed pattern"**
  - **"My spray pattern is weak"**
  - **"Output (L/ha or gpa) is high"**
  - **"Not available for boom-ends"**
  - **"Crystals form inside"**
  - **"They don't work with drift adjuvants"**
  - **"Nozzle supply is limited"**
  - **"Weed escapes, everywhere!"**

AI Backlash

- In Ontario, the biggest problems was that growers were still trying to use high-pressure AI nozzles at the traditionally low 40 psi pressure.
- Given that certain herbicides (or as we later found out, certain weed/product/nozzle combinations) didn't perform well, agrichemical companies pushed extension to **stop promoting them!** They began to tell growers to go back to the XR for certain products.

- There were at least **eight AI nozzle manufacturers** at the time, and nozzle-make and operating pressure had an impact on efficacy. So, extension specialists tried to correlate nozzle brand to weed to product.

Breakthrough – late 1990s, early 2000s

- **Dr. Tom Wolf**, a federal spray researcher in Saskatoon, Saskatchewan tested multiple brands of AI nozzle and showed that spray pressure had an impact on control for contact products on grassy or hard-to-wet weeds.

- He proposed categorizing them as **LOW PRESSURE** and **HIGH PRESSURE AI's**.

- For contact herbicides, he said low pressure AI's should be operated at 40 to 60 psi, and high pressure at 60 to 80 psi. One brand of AI nozzle was found to require 80 to 120 psi to give acceptable coverage.

Impact

- **Dr. Tom Wolf also showed that depending on the weed, the reduced droplet density produced by an AI nozzle can be critical. Basically, fewer drops means you can miss small weeds.**

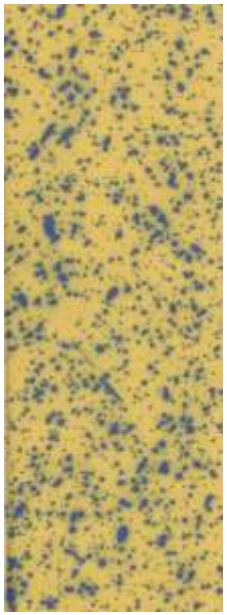
- **His words:**

"Among herbicides and weeds, broadleaf weeds and Group 2 and 4 herbicides can actually work better with coarser sprays. Grassy weeds and Group 1 herbicides prefer finer sprays. A Group 1 and Group 2 tank-mix can be applied with a Coarse to Very Coarse spray but water volume should be kept above 7 gpa."

- **Once these concepts were promoted, a lot of the problems went away.**

Canadian Adoption Rates

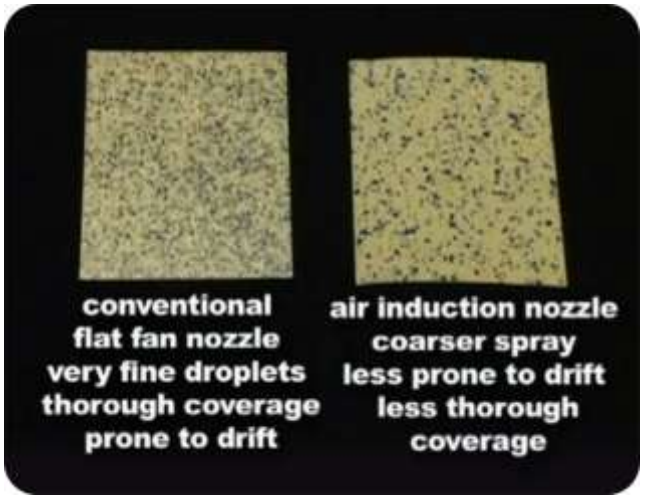
- **Custom Applicators in Ontario have had high adoption rates, probably ~80%.**
- **In Ontario and Western Canada, producers who spray their own operations have adoption rates of 60% or more.**
- **Personally, I've been working with Ontario airblast operators to encourage them to try AI nozzles. I'm guessing we're less than 5%, but I've only been preaching for a year… give me time – we got funding for 2012 research.**



Spray pattern from deep in an apple canopy using air induction tips at 750 L/ha.

How Can We Promote Adoption of AI?

- **Continue to extend information to growers at every opportunity, such as Tom Wolf and Bayer's video on Nozzle Selection and Set Up: (http://www.youtube.com/watch?v=NyOU6RtXcX4)**

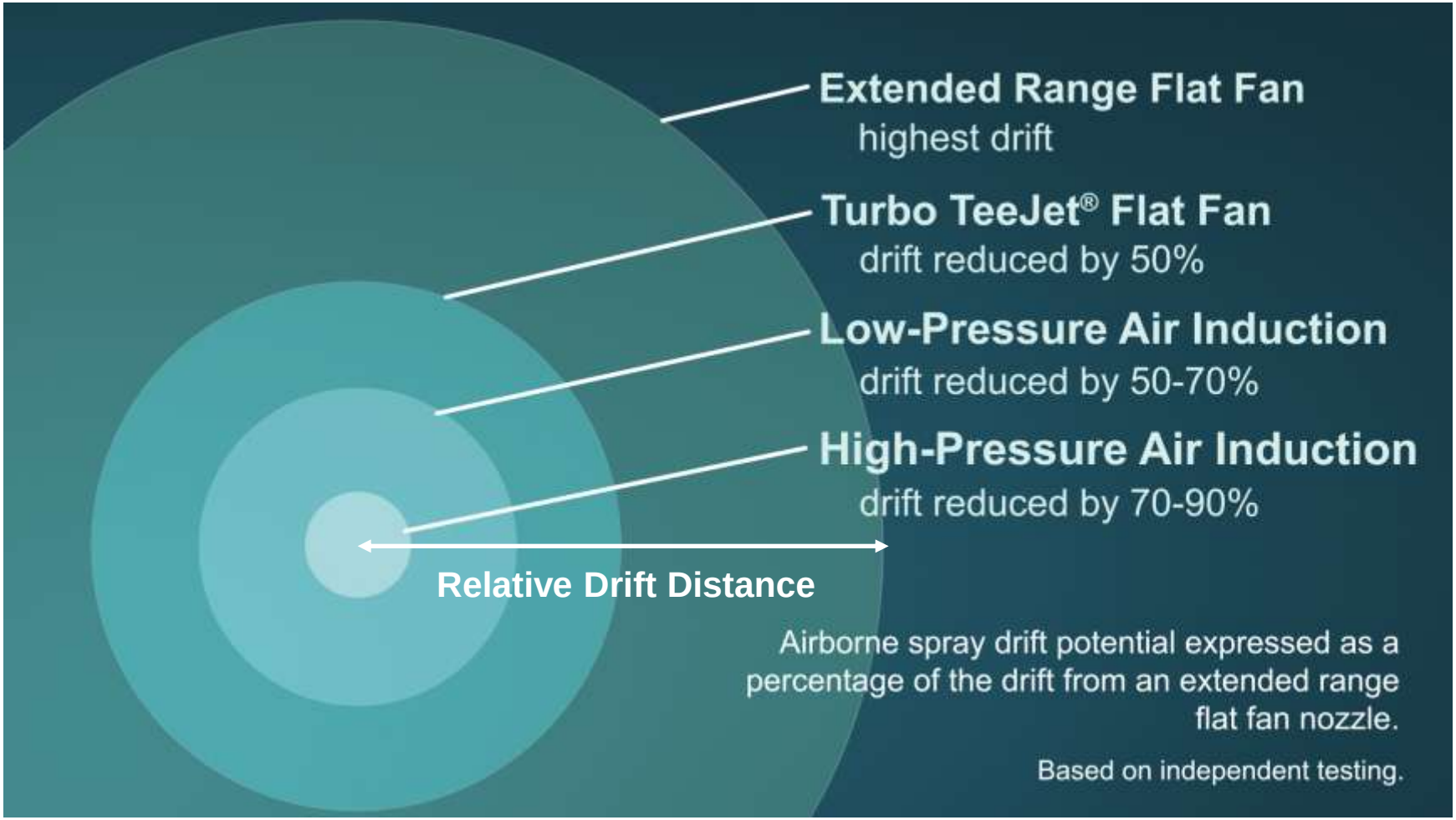


- **Consider tying air induction nozzles and operating parameters to agrichemical products, such as Syngenta's Amistar AI nozzle and Cherokee (UK) on cereals. Help growers by providing clear instruction: (http://www.youtube.com/watch?v=nr8GDhEHT7w)**

AI on Airblast Sprayers

- **Selling Point:** Very hard for onlookers to see spray

As a Drift Reducing Strategy, AI Works!



Based on work by Brian Storozynski in Saskatoon, Saskatchewan in the late 90s

Answers to Reported Problems

- **Are AI nozzles prone to plugs?**
  - *No more than normal nozzles. In fact they have larger, round exit orifices that should prevent plugs. If the air inlet plugs, the impact is minor; usually slightly finer spray.*
- **Why is my spray quality poor?**
  - *Likely because you are operating the nozzle at the wrong pressure. Most often the grower uses too low a pressure.*
- **Do AI nozzles work with all herbicides?**
  - *Yes, but contact herbicides and grassy or hard-to-wet weeds need special consideration. Consider raising your output volume and pressure.*

Low Pressure AI Nozzles – late 2000s

- The story continues…
- TeeJet recently released their new Low Pressure venturis:
  - TTI Turbo TeeJet Induction (2005)

  - AIXR TeeJet (2007)

- We're back to operating ranges as low as 15 psi. Who knows what that will do to grower opinion and adoption? In-field testing has to continue.

Hofman's Bottom Line:

"You may not want or need to use venturi nozzles under all conditions. Think in terms of using the 'right spray for the condition.'

The Finer sprays are more appropriate for most insecticides and fungicides and for grassy weeds. Coarser sprays will work well for broadleaf weeds and when penetrating a small-grain canopy. You may also want to consider having two different flow rates available—for example, 5 to 7 gallons/acre will improve performance for glyphosate, and 10 gallons/acre or more may be required for other herbicides and most contact products."

From Hofman, N. Dakota State, 2003

Thank You

"Choosing Drift-Reducing Nozzles FS919 – 2003"
NDSU Extension, V. Hofman and J. Wilson

"Tom Reed – Personal Communication"
~30 years with Spraying Systems (TeeJet)

"Helmut Spieser – Personal Communication"
~25 years of sprayer extension in Ontario

"Dr. Tom Wolf and Brian Storozynski – Various Publications"
Combined, >40 years in Western Canada performing sprayer research