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## SPRAYER TECHNOLOGY RESEARCH SHEDS LIGHT ON SYSTEM PERFORMANCE

More research is needed to determine how well sprayer equipment works under varying conditions and specific applications.

Seven years of field research completed by the AgTech Centre in Lethbridge will help prairie farmers make better decisions in selecting sprayer equipment, and get the best value from crop protection dollars.

With the battery of pesticides available today, effective control of crop pests sounds simple, but it is a complex issue, says Brian Storozynsky, sprayer technology specialist at the AgTech Centre. Aside from selecting the actual pesticide, producers face an ever-expanding lineup of application equipment and nozzles.

### Equipment choices

While far from obsolete, the pull-type sprayer equipped with model 8002 flat fan nozzles is no longer the benchmark sprayer system. That type of equipment has served the industry for decades. Today however, sprayers include conventional pull-types, self-propelled high clearance units, hybrid combinations of pull-type, high clearance sprayers and sprayers equipped with updated and improved air assist and electrostatic sprayer accessories.

The standard flat fan nozzle is now just one of a host of nozzle types, designs and capacities made by more than a dozen manufacturers. Options include the standard nozzles, extended range nozzles, pre-orifice, combo jets and air induction nozzles with a range of models within each type.

Along with equipment, producers also have to weigh the sometimes conflicting and controversial claims that use of specific sprayer and nozzle technology makes it possible to reduce both chemical and water rates while achieving as good as or better weed and disease control. The offer to treat



more with less, and maintain product efficacy has huge appeal in helping reduce crop input costs, but does it work?

“Producers really want to know what is the most effective nozzle providing the best balance between coverage and reduced drift,” says Storozynsky. “What’s the best system? And there are really no simple answers.”

### Extensive research

AgTech lab and field research have addressed several key issues. Using both wind tunnel simulation along with extensive field-scale testing in grain, oilseed and some special crops, Storozynsky has evaluated key sprayer technologies for effectiveness in spray coverage, herbicide efficacy and reducing spray drift in typical in-crop weed, disease control and desiccant treatments. The latest nozzle technologies, along with several air assisted technologies were tested at conventional pull-type and high clearance spraying speeds and setups. Each of the six technologies tested represented one of the ASAE Standard S-572 droplet size classifications.

## In this Issue

- Sprayer Technology Research Sheds Light on System Performance
- More on Nozzles, Shrouds and Air Assist Accessories

# 25 YEARS OF TECHNOLOGY AND DRIFT

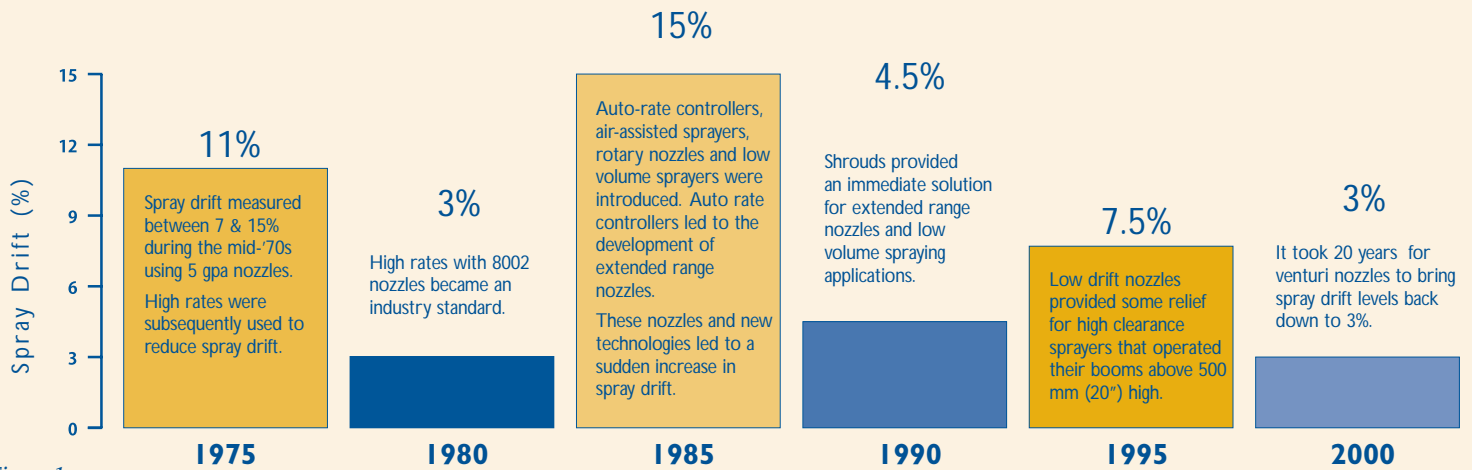


Figure 1

“We’re finding some of the answers, but there are many more issues to be addressed,” he says.

## Reducing drift

Nozzle research with specially designed field-scale sprayer equipment that represents various sprayer types has generated some interesting results in the bid to reduce airborne spray drift. Key points include:

- Pre-orifice nozzles, such as Turbo TeeJet and DriftGuard, reduced drift by as much as 50 percent over extended range nozzles.
- Low-pressure venturi nozzles, such as the Air Bubble Jet and Airmix, reduced drift by 35 to 60 percent compared to pre-orifice (low drift) nozzles. For best results these nozzles should be operated between 25 and 60 pounds per square inch (psi), averaging around 40 psi, but regardless of manufacturer recommendations, not lower than 25 psi.
- High-pressure venturi nozzles, such as the TurboDrop and AI TeeJet, reduced drift by 60 to 90 percent compared to pre-orifice nozzles. They can be operated at 40 to 120 psi with an average of 75 psi, but regardless of manufacturer recommendations, not lower than 40 psi.
- High-pressure venturi nozzles are best suited for high clearance sprayers if drift is the primary concern. The nozzles produce a coarser droplet size, which has a lower risk of drift when higher spray booms are used. Low-pressure venturi nozzles are sufficient for pull-type equipment.
- Shrouds are still needed. The combination of a conventional sprayer equipped with low drift or venturi nozzles and a shroud produces optimum drift reduction at higher wind speeds.

## Herbicide efficacy

AgTech research showed some surprising results as to how well various types of equipment worked in providing post-emergent weed control.

- Recommended pesticide label rates worked in most cases. No matter which sprayer or nozzle type was used, the recommended rates for water and chemical, in most

situations, achieved at least 85 percent weed control. That wasn’t always the case in research using reduced water and herbicide rates. In some trials with herbicides such as Roundup Transorb, Odyssey, Liberty, Everest/Buctril M, Puma Super/Refine Extra/MCPA and Everest/Thumper, there was reduced weed control at lower herbicide rates. For research purposes, herbicide rates were reduced by as much as 50 percent to aid in understanding the effectiveness of different spray coverage and droplet size.

- There was little or no difference among sprayer types as far as effectiveness in weed control. At maximum ground speed of 12 miles per hour, conventional pull-type, high clearance and air assist sprayers were about equal in their performance whether applying a systemic or contact-type herbicide. Air assist and electrostatic sprayers with fine to very fine spray droplets appeared to be more effective in fungicide application on field bean crops.



Brian Storzynsky stresses field-scale testing.

- Air-induction venturi nozzles, which deliver a coarser spray, provided as effective weed control as other nozzle types most years. It has long been viewed that a finer droplet size provided better coverage and therefore improved herbicide efficacy. But research showed venturi nozzles were just as effective, four out of five years, as nozzles producing a finer spray. The exception was reduced control in plots with a dense population of grassy weeds, and especially at reduced herbicide rates.

### Expanded research

Control of spray drift and herbicide efficacy continue as focal points of ongoing sprayer technology research, says Storozynsky. In future research he hopes to evaluate equipment and pesticide performance in a wider range of situations.

“To date we’ve primarily looked at how these systems worked in post-emergent or in-crop treatments in grain crops,” he says. “And with our research sprayers, the maximum practical ground speed is 12 miles per hour. We plan to continue research to measure performance of sprayers at ground speeds up to 17 and 20 miles per hour and under a wider range of crop and spraying conditions.”

While improved sprayer technology has helped reduce spray drift dramatically in recent years, Storozynsky wonders if more gains can be made. With the recent introduction of venturi nozzles, spray drift has been reduced to about three percent. That’s down from about 7.5 percent in the mid-’90s and as much as 15 percent in the mid-’80s. (See Figure 1, page 2, which illustrates spray drift trends over the past 25 years.)

### Drift and efficacy questions

Minimizing drift is important from crop safety, legal liability and environmental aspects. “The more we can use sprayer technology to keep pesticides where they are intended, the better,” says Storozynsky. “Low pressure venturi nozzles, for example, potentially produce more drift than high-pressure venturi nozzles, but adding shrouds on ground sprayers may make it possible to operate under higher wind conditions and still maintain low drift levels.”

Herbicide efficacy is another key aspect of sprayer technology research. Along with in-crop treatments in cereals, Storozynsky plans to evaluate how equipment works in a wider range of field conditions.

“Our research to date shows most equipment worked equally well in applying a post emergent herbicide,” says Storozynsky. “But my personal theory is the crop also played a role in controlling weeds. The herbicide was effective, but the crop provided competition, which further helped control weeds that were partially stunted by the herbicide. So the question is, how well does the sprayer technology work under different conditions.”



*Testing shrouds at AgTech.*

### Future issues

While time and money are always limiting factors, Storozynsky says there is a growing list of research needed to answer sprayer technology questions. Future projects will:

- Evaluate equipment performance and herbicide efficacy for different applications ranging from a pre-seeding burn-off to pre-harvest treatments.
- Evaluate herbicide efficacy with new sprayer technologies and ultra low water rates.
- Evaluate sprayer equipment and herbicide efficacy at faster ground speeds, up to 20 miles per hour, to better reflect on-farm application.
- Evaluate nozzle location and orientation on the spray boom. Is there improved coverage and herbicide efficacy if nozzles are angle-mounted to spray forward and/or backward into the crop canopy?
- Evaluate the effect of water quality. For example, does pure or mineral-free water affect the efficacy of herbicides?

“These are just some of the questions we hope to look at,” he says. “While research provides many answers, it also seems to prompt new questions. It’s important to look at these issues under field-scale conditions. Small research plots are useful, but we need to test the technology in situations that represent true field operating conditions.”

### MORE INFORMATION

More information on existing and ongoing sprayer technology research can be found in a range of AgTech Centre evaluations on field sprayers, accessories, monitors and controllers, guidance systems, and spray drift research results. As well, sprayer technology is also covered in AgTech Centre Innovator newsletters and other special reports.

Reports can be found on the Ropin’ the Web Web site at <http://www1.agric.gov.ab.ca> ; by contacting Alberta Agriculture’s publication office in Edmonton at 1-800-292-5697; or by contacting the AgTech Centre directly in Lethbridge at 403-329-1212.

# MORE ON NOZZLES, SHROUDS AND AIR ASSIST ACCESSORIES

Combining technology may improve spray performance.

Research often presents surprising results that conflict with conventional thinking, says Brian Storozynsky, sprayer technology specialist. Twenty-five years of sprayer technology experience and seven years of extensive field testing point to trends and conclusions not everyone agrees with.

Even though air-induction venturi nozzles, for example, deliver less coverage on the plant surface, herbicide efficacy doesn't appear compromised, at least not in post-emergent chemical treatments. In most of the dozens of treatments involving both contact and systemic herbicide products were equally effective regardless of nozzle type.

Although coverage/droplet size varies depending on the nozzle, size and operating pressure range produced by different manufacturers, the research shows, in relative terms, that venturi nozzles, which deliver about 35 droplets of chemical per square centimeter (cm<sup>2</sup>), appeared to be as effective as nozzles that deliver much finer sprays. That contradicts conventional thinking, but the research results speak for themselves.

Extended range nozzles used in this research, produced fine to medium sprays, with coverage of about 125 to 150 droplets per cm<sup>2</sup>.

Air assist and electrostatic systems are above 200 droplets per cm<sup>2</sup>.

Turbo TeeJet nozzles on research equipment, produced medium to coarse sprays with a droplet density of about 75 to 100 droplets per cm<sup>2</sup>.

Venturi nozzles produced coarse to extremely coarse sprays with a droplet density of about 20 to 50 droplets per cm<sup>2</sup>.

"With the coarser droplets produced by venturi nozzles, drift is reduced," says Storozynsky. "Standard thinking is coarser droplets would reduce efficacy, but that wasn't the case. Control with venturi nozzles was just as good as with nozzles producing finer droplets. That result surprises many people."

## Fit for shrouds

Sprayers equipped with low-pressure venturi nozzles can produce more spray drift than high-pressure venturi nozzles.



That's another contradiction, says Storozynsky. "In the past, high pressure has been associated with high drift, but not with the high-pressure venturi," he says. "When operated between 40 and 120 psi, drift is reduced."

To minimize drift with ground sprayers in higher wind speeds, shrouds should be considered, says Storozynsky. With the development of low drift nozzles, producers trended away from using shrouds, but shrouds may help increase the operating range of low pressure venturi nozzles.

"Shrouds were popular up until the mid-'90s, but dropped off with the introduction of newer nozzle technology," says Storozynsky.

While it's an area of ongoing research, he suspects low drift levels can be maintained even under slightly higher wind conditions, if shrouds are used in conjunction with low pressure venturi nozzles.

## Role for air assist

Expanding research treatments to include pre-emergent, pre-harvest herbicide and insecticide applications may better demonstrate the potential benefit of sprayers equipped with air assist and electrostatic technology, says Storozynsky.

The sprayer accessories, intended to boost the performance of spray penetration on high clearance sprayers, increase over-all sprayer costs and need more horsepower to operate. However, some manufacturers claim improved spray deposition and penetration increases efficiency, which means both herbicide and water rates can be reduced.

Storozynsky's research under field conditions, showed air assist and electrostatic sprayers performed as well as standard pull type and high clearance sprayers for post-emergent applications at 5 and 10 gpa. Results may be different in a pre-seeding burn down where weeds have no crop cover, or in a pre-harvest herbicide treatment, which generally means higher and heavier crop canopy.