

The Case for Low-Drift Sprays

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Many PEI growers already use low-drift nozzles to apply crop protectants. Tom Wolf, who spoke at the Potato Technology Expo in February, explains the benefits of low-drift nozzles and dispels some of the myths about this technology in this guest article.

“Should I be using low-drift nozzles?” It seems like a simple question with an obvious answer. We all want to reduce spray drift, and this easy-to-use technology is the fastest way to get there.

And yet, the question is more complicated than it first appears. Yes, all applicators want to reduce drift, but many worry about the coarse sprays produced by low-drift nozzles. As a spray volume is divided into coarser (i.e. larger) droplets, there are fewer of them, and that can reduce coverage. It’s a legitimate concern.

Let’s start with our shared value first – the desire to reduce spray drift.

Given the economic, environmental and health impacts of spray drift, the importance is hard to over-state. That’s why spray drift management is a primary concern of our federal regulators whose job is to protect the public interest. It’s also a concern for the neighbours who have a right to keep unwanted products off their property, whether it’s residential or agricultural.

For these reason, managing drift should be a foremost

concern for applicators. The technology is vital to the crop production industry, and if we don’t take care of the issue, someone else will take care of it for us. That’s not the best path.

Much has been written about how to reduce drift. The key points are:

- choosing days with better weather,
- lowering booms and travel speeds,
- watching spray pressure,
- protecting the spray with shields,
- using coarser spray qualities on the whole.

Of these, the most economical and practical is using coarser sprays via low-drift nozzles. Engineered to emit fewer fine droplets, they are proven to reduce drift by anywhere from 50 to 95% compared to a standard flat fan of the same size. When it comes to reducing drift, they work.

When these tips first hit the mainstream as “pre-orifice” nozzles in the late 1980s, and later as “venturi” nozzles in the mid 1990s, we were impressed with their ability to reduce drift. And the obvious question was, what about product efficacy? Can fewer, larger droplets do the job? The answer, to our initial surprise, was yes.

In the late 1990s, the crop protection industry (including



Conventional flat fan nozzles (XR8004) operating at 40 psi



Low-drift nozzles (TD11004) operating at 60 psi



Glyphosate drift with 20 km/h side wind, XR8004 40 psi



Glyphosate drift with 20 km/h side wind, TD11004 60 psi

governments, universities, and the private sector), participated in studies throughout Europe, Australasia, and North America looking at low-drift spray performance. In Canada alone, we conducted over 100 studies and concluded that pesticide efficacy was not harmed when a properly adjusted low-drift nozzle was used. A surprising result showed that fungicides did not seem to need finer sprays, contrary to popular opinion, as long as water volumes were sufficient to provide adequate coverage.

As we did more and more studies, it became apparent which points were critical:

1. When using venturi nozzles, spray pressure had to be increased from the industry standard of 40 psi to about 70 psi. This is because of a venturi nozzle's two-stage design. The high pressure compensated for an internal pressure drop inside the nozzle. Sprays remained low-drift, but patterns and overall efficacy were better at this higher pressure.

2. Spray pattern overlap needed to be greater with low-drift sprays - a full 100%. In other words, the edge of one nozzle's spray pattern should reach the middle of the adjacent nozzles' patterns. The pattern width at target height was now twice the nozzle spacing and this ensured good distribution of not only the spray volume, but droplet numbers, along the boom.

3. We needed to pay attention to the target plant architecture and leaf surface properties. Plants such as grasses (with vertical surfaces and difficult-to-wet leaves) often had less spray retention with coarser sprays. Low-drift nozzles worked, but we couldn't go as coarse in these cases. Careful selection of low-drift nozzles as well as more attention paid to operating pressure solved these issues.

4. Our minimum water volumes had to increase slightly to compensate for the fewer drops produced

by low-drift sprays. This was especially true for contact modes of action where too few droplets-per-area reduced performance. Using an Extremely Coarse spray at a very low water volume was asking for trouble.

While we were learning how to tweak low drift nozzles to get them to perform, we also learned there were significant advantages to using coarser spray qualities.

1. Foremost, there was an immediate reduction in drift. One applicator told me years ago that switching to a low-drift spray removed a huge burden of worry from him, and that alone was worth it.

2. Low-drift sprays made it easier to spray on-time, even if weather conditions were marginal for conventional sprays. The result: the timely removal of weeds, or the correct staging of fungicides and insecticides. This has paid large dividends in terms of protected yield.

3. Coarser sprays can protect us from some adverse conditions, such as days with high evaporation rates. On such days, fine sprays evaporate to dryness so quickly that uptake can be limited. Larger drops stay liquid longer, with more uptake the result.

4. Directed sprays, be it banded sprays or twin fan nozzles for fungicides, make more sense from coarser nozzles. The reason is that these coarser sprays go where they're pointed, whereas fine sprays lose their path in wind or through travel-induced deflection, very quickly.

5. We also learned about the air-entrainment that coarser sprays can produce. Large droplets dragged air with them, and smaller droplets could hitch a ride in their wake. This provided a form of air-assistance that reduced drift and carried small droplets into the canopy. Finer sprays had a harder time producing this type of drag, and sustaining it in the canopy.

When we analyzed the droplet size spectrum of coarse and fine sprays, we confirmed that the total number of droplets produced by any given volume of water had been reduced. Not a surprise. But two things struck us.

First, even though the average size of droplets in coarse sprays were very large, they still contained a population of small droplets. In fact, if you counted every single droplet in the spray, the vast majority were small and they were still taking care of coverage.

Second, the critical amount of coverage (measured as the percent of the surface area covered by spray deposits) that was necessary for a given product to work was lower than what we'd been aiming for. In other words, we didn't need as much coverage as we thought we did, and any excess didn't actually add to product performance in most cases.

We later analyzed the relationship between spray coverage and herbicide performance and found that the uniformity of the deposits was actually more important than the amount of coverage per se. So, if we focussed on proper overlap and spray pressure there was greater benefit than increased coverage alone. Deposit uniformity has become our research focus of late.

So, should you be using low-drift nozzles? By adopting the changes in pressure, overlap, and water volume outlined above, and paying more attention to the plant architecture and pesticide mode of action, we've been very successful in implementing low-drift sprays in all field crops. In my view, we can safely retire fine sprays for all field crop pesticides. This means conventional flat fan nozzles, hollow cone nozzles, and the like. Get rid of them. All they do is add drift potential.

It's safe to adopt low-drift sprays. Research and experience from the field prove that they work. Low-drift sprays should be viewed as an agronomic

tool that improves application timing and accuracy. And with less drift, we show that agricultural practice can be both efficient and environmentally responsible. That's going to be a very important story to tell, now and in the future.



Top: Spray pattern of conventional spray (XR8002, 40 psi)

Bottom: Spray pattern of low-drift spray (ULD12002, 60 psi)

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