Spray variability may be costing you big bucks

Several factors can cause uneven spraying — and they almost always come down to speed

Uneven boom height is one of several issues that can lead to "underdosing" when spraying. PHOTO: TOM WOLF

In some parts of the field, as much as half of the herbicide you spray may not hit the target, says a spraying expert.

And while there are a host of factors involved — including turns, boom height variability, and turbulence — more often than not, the culprit is speed, said Tom Wolf.

The result is lost yield because some weeds receive sublethal doses of herbicide, or none at all.

Ongoing research suggests that "deposit fluctuations" from high-clearance sprayers driven at high speeds can be as much as 50 per cent, said Wolf, a well-known spray expert and president of Saskatoon-based Agrimetrix Research and Training.

"The more variable the deposit, the higher we have to adjust our average rates to accommodate those fluctuations," he said. "We are not recommending going off-label — products have always been registered at higher rates to allow for these variations.

"But this is inefficient and can lead to lower-than-expected product performance under conditions when the pest is more difficult to control."

Technology can help in some cases. Pulse width modulation systems, for example, optimize flow on turns via pulsing solenoids located at each nozzle.

But if you really want to make a difference, lose that need for speed, said Wolf.

"Maybe we just have to become more productive in ways that allow us to drive slower," he said.

"How are you spending your spraying day? Are you actually spraying? Or are you spending a lot of time on other things such as filling or cleaning the sprayer — both of which are big time consumers that together actually take more time than the spray operation.

"Maybe you can fill faster or clean faster, and then use that saved time to drive slower."

Wolf's website (www.sprayers101.com) has articles on more effective ways to spray and other related topics, but here are some of his top tips:

Spray early

Attack weeds when they are more vulnerable — that is, when they're small.

"We all know that a weed becomes more difficult to control the bigger it gets," said Wolf. "If we allow that to happen, the likelihood that a larger

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weed will survive treatment is also greater. To avoid herbicide resistance, we want to make sure we have complete removal of all the weeds we spray."

Deal with turn problems

"A boom is up to 120 to 130 feet wide these days," said Wolf. "When you make a turn, obviously the outer wing of that boom is going to go faster and your inner wing is going to go slower. In some of our simulations, if you're driving 20 kilometres per hour the outer wing might be going 32 kilometres per hour."

This "underdosing" can reduce the amount of chemical hitting weeds on the outer rim by half. Worse still, there can be a cumulative effect.

"If we make the same turn year after year in the same location, the same places get repeatedly underdosed with herbicide. We can easily be underdosing 40 to 50 per cent under the outer spray boom each pass."

This favours your most problematic weed species.

"It means we are selecting for harder-to-control weeds, which will eventually become more prevalent. If the plants are outcrossing, it's been shown that repeated underdosing can lead to polygenic herbicide resistance."

Technology can help

Traditional systems use spray pressure to adjust flow, but the pressure (and its effect on flow) is applied equally to the entire boom. A Pulse width modulation system (PWM) can adjust flow to each nozzle individually via pulsing solenoids located at each nozzle.

"The solenoids pulse at 10 or 15 Hz (times per second) and the proportion of time that the valve is open — called duty cycle — is proportional to flow rate," said Wolf. "A fivefold flow rate range is possible."

Turn compensation is offered as part of most PWM systems such as Capstan PinPoint and the new EVO, Raven Hawkeye (available as AIM Command on Case and IntelliSpray on New Holland), TeeJet DynaJet, and most recently John Deere ExactApply. GPS identifies how fast each part of the boom is travelling and software adjusts valves on each nozzle accordingly.

"If the outer wing needs 30 or 40 per cent more flow because of a turn, the system has the capacity to deliver that extra flow just to those nozzles. The opposite effect happens on the inner wing; we choke the flow back because we are overdosing."

A new system from Germany's Amazone called SwingStop essentially combines these two technologies by monitoring boom movement with an accelerometer and then compensating for any stray movement using hydraulics and pulse width nozzles.

Recognize high-boom issues

"We are struggling as an industry with the fact that our sprayers are getting bigger, our booms are getting wider, and our travel speeds are increasing," said Wolf.

Booms are now higher in order to prevent them hitting the ground and being damaged. But that also means the distance between nozzles and weeds is greater. And that often reduces the amount of herbicide hitting their target.

"This is inefficient and can lead to lower-than-expected product performance."

TOM WOLF

PHOTO: ALFFOTO/ISTOCK/GETTY IMAGES

And while most sprayers have automatic sensors to determine boom height and hydraulically adjust it, that technology doesn't work when the sprayer is going at a high speed, said Wolf.

"Those adjustments need a bit of time and at fast travel speeds, farmers will typically need to raise their boom to three feet above ground. Due to sway, sometimes the boom is only a foot and a half off the ground and sometimes it's four feet off the ground. It's unacceptable."

However, there's no going back, he added.

"Variable boom heights were not a problem 20 years ago. Back then most of our sprayers had wheels on the outer wings and they kept consistent boom height, at least in Western Canada. Unfortunately, those days are gone — we've replaced those pull-type sprayers with suspended boom systems to spray mature canopies."

Factor in turbulence

"Driving our sprayers faster exposes the spray to greater wind speeds and greater possible turbulence often induced by the sprayer itself," said Wolf.

"The smaller spray droplets respond to that. They say, 'Hey, we can't deposit here because there's too much flow here so we are not going to drop to the ground. We'll go somewhere else.'"

This problem tends to be most evident on the outer wings of the boom (and the structure of the boom itself can cause turbulence in specific spots).

There are currently no technological solutions to turbulence, at least at today's travel speeds, said Wolf.

"We probably need to design more aerodynamic sprayers if we want to travel fast."

Keep abreast of research

These preliminary results are the product of two research programs. One is the Prairie-wide Canola Agronomic Research Program (funded by the Canola Council of Canada and provincial canola commissions). One of its projects (Characterizing Turbulent Spray Deposition from Self-Propelled Sprayers) has been running for three years and wraps up this spring.

The Western Grains Research Foundation is also conducting research (Spray Drift Management Under Changing Operational Requirements).