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The ins and outs of dicamba application.

Best management practices for dicamba use.
By: Rob Miller

For many growers, the introduction of Roundup Ready 2 Xtend® dicamba-tolerant soybeans is a welcome alternative for weed management. This systemic, Group 4 herbicide is very effective at controlling problematic broadleaf weeds such as dandelion, vetch and sow thistle, along with several glyphosate-resistant biotypes including Canada fleabane, waterhemp and ragweed species. This new system also lets us use an additional mode of action in-crop to control later-emerging weeds.

Note that dicamba products are registered for use on Roundup Ready 2 Xtend dicamba-tolerant soybeans only. Non-dicamba-tolerant soybeans and select horticultural crops are very sensitive to dicamba, with visual crop injury observed at doses as low as 0.125%. So how can we minimize off-target effects while still taking full advantage of the chemistry?

Is it volatility or drift?

When it comes to dicamba off-target movement, there are concerns around volatility and drift. But what's the difference?

Volatility

A herbicide's volatility is dependent on its chemistry and formulation. Once applied, a fraction of the spray solution vapourizes off of its target surface and moves off site by wind or air. This vapour can move upwards of a few kilometers from the intended target,[1] and the degree of volatilization is greater off of green tissue than bare ground. That is why pre-plant applications are generally considered lower risk versus late post-emergence. New dicamba products are now designed to reduce volatility, and only these new formulations should be used in Roundup Ready 2 Xtend soybeans. Engenia® herbicide, for instance, uses an improved salt formulation with lower volatility properties, as well as a higher concentration for a lower use rate. Even though there are newer formulations on the market, applicators still need to incorporate best management practices to reduce volatility.

Drift

Drift is the physical movement of spray droplets via wind or rain to non-targeted areas. A number of factors can affect spray drift such as wind speed and direction, temperature, humidity, droplet size and ground speed. However, we can manage and mitigate the risk of spray drift by taking precautions and adjusting sprayer settings.

Best practices

Here are some precautions and sprayer recommendations for an effective dicamba application:

Nozzle choice and spray quality

Coarser sprays help to reduce driftable fines. The larger the droplet size, the less likely it is to move off target. For dicamba applications, use nozzles that produce extremely course to ultra coarse droplets – this is known as your spray quality.

Spray pressure affects the flow rate coming through the nozzle, altering your spray quality and spray pattern.[2] Note that each nozzle has a unique spray pressure range, so be sure to check the manufacture's guidelines. Unfortunately, you cannot equip your sprayer with only one nozzle for all applications, so consider specific nozzles dedicated for dicamba applications.

Application volume

Use at least 10 gallons per acre. The greater the volume, the better the coverage – especially for larger weeds and glyphosate-resistant species. Using larger droplet sizes means fewer droplets, which can be challenging for glyphosate to control grasses. Use higher water volumes to compensate for this, and adjust as needed in order to produce the right spray quality.

Ground speed

Maintain a ground speed of 25km/h or less. Since ground speed determines spray pressure, which in turn determines droplet size, your pressure gauge should be your speedometer. Use spray quality charts and adjust travel speed and spray volume to produce your expected spray quality. Take into account "apparent wind speed", which is your ground speed and wind speed added together.[1] For example, if wind speed is 10km/h and you're driving 25km/h into the wind, your nozzles will experience an apparent wind speed of 35km/h.

Wind speed

Apply dicamba with wind speeds between 3 km/h and 15 km/h, as high winds encourage drift and lead to uneven coverage. Ensure that the wind is moving in a direction opposite to sensitive crops. Avoid periods of dead calm and temperature inversions.

Boom height

Keep the boom no higher than 50cm above the crop canopy. Spray droplets start to decrease in size the minute they're released.[2] The higher the boom, the more time there is for evaporation and drift to occur.

Sensitive crops

Be aware of any nearby sensitive crops. Use Health Canada's Buffer Zone Calculator to determine the correct buffer zones based on your weather conditions and sprayer settings. Make note of any dicamba-sensitive species such as non-dicamba-tolerant soybeans (**Figure 1**), horticultural crops, orchards, greenhouses, tomatoes or tobacco.

Dicamba affects new growth and symptomology will appear two to three weeks later. Since there is a delay in the appearance of visual symptoms, the cause is often mistaken for product volatility, when in fact the culprit is likely to be spray drift that occurred at the time of application.

Figure 1. Cupping caused by dicamba drift in non-dicamba-tolerant soybeans.
Source: Ontario Ministry of Agriculture and Food, 2009.[3]

Additives/adjuvants

Use only approved tank mixes and adjuvants on label. Do not tank mix ammonium salts (AMS or UAN), ammonium salt forms of glyphosate or acidifying water conditioners with dicamba. These can lead to the formation of ammonium dicamba acid, which can affect volatility properties.

Sprayer cleanout

This is a very important step and is often overlooked due to time constraints. Triple rinse the tank, all plumbing, screens, filters and nozzles with a detergent-based cleaner. Double check end caps, filters and other possible dead zones where herbicides can settle and get stuck. Ongoing research suggests that dicamba spray tank contamination at levels as low as 0.125% can lead to visual injury symptoms in non-dicamba-tolerant soybeans.[4,5] Be sure to rinse out the tank immediately after application, and clean the outside of the sprayer as well.

Temperature inversions

During the day, the earth heats up more quickly than the cooler air above it. The warm, light air rises before it cools and falls, moving and mixing the air vertically. But as the sun goes down, heat from the ground dissipates more quickly than the air above it. The result is a layer of cool, dense air trapped below the warm air, effectively stopping the air from rising. Think of it as a barrier between the two layers. Without this vertical mixing motion, applying a herbicide at this time could leave spray droplets lingering in the cool, lower air. All it takes is a light breeze to move this air horizontally, carrying any spray droplets off-target with it (**Figure 2**).

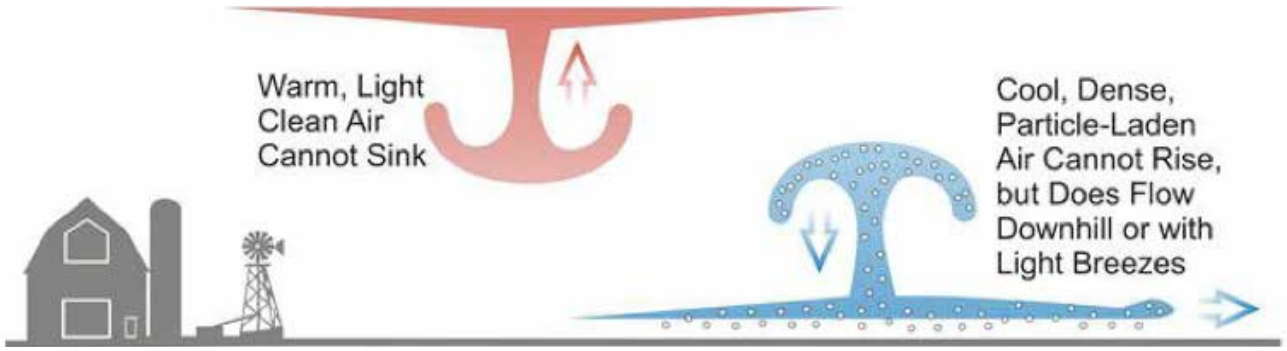

Figure 2. Temperature inversions can lead to spray drift.
Source: Deveau, J. 2016.[1]

Indicators of a temperature inversion include: 1) clear sky with no wind, 2) the presence of dew or frost, 3) ground fog in low lying areas[6] and 4) high temperatures with low humidity.

Temperature inversions begin to build on a calm, cool evening, and reach the greatest intensity at sunrise the following morning if conditions persist. A prime example of a temperature inversion is when you see dust or chimney smoke lingering in the air.

Last but not least, take detailed notes. This includes the date and time of spray, temperature, wind speed and direction, as well as the weeds and crops treated. This will help you determine what worked or what didn't work, and figure out how to improve application practices in the future.

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Why your new soybean system could use more modes of action.

Pre-plant application strategies for dicamba-tolerant soybeans.
By: Rob Miller

It's well-known that effective, early season weed management is key to protecting your soybean's yield potential. But when it comes to choosing a suitable strategy, glyphosate alone isn't as effective as it used to be.

The best method is to start clean and stay clean. The importance of the critical weed-free period has been well-established in the past, from the first to third trifoliate stages.[1] However, recent research from the University of Guelph has suggested that soybeans react to the presence of weeds as early as emergence,[2] while other studies have shown an effect up until the 4th trifoliate stage.[3] These results underscore the importance of early season weed control.

Figure 1 is a perfect example of why early weed control plays such an important role. Both treatments received two applications of glyphosate: the first at pre-plant followed by a second in-crop. However, a broad-spectrum residual herbicide was added to the burndown in the field to the right. The end result wasn't just a clean field – the soybean plants were much larger and robust.

Figure 1. Residual activity and additional modes of action lead to more robust plants.

Source: BASF research trials, Ridgetown, ON, 2011

For effective control of tough weeds, add an additional mode of action to your glyphosate burndown.

Not all weeds are controlled

Glyphosate has a very broad weed spectrum, and its systemic activity can be very effective for translocation to the roots. However, larger winter annuals and perennials can be difficult to control with spring glyphosate applications, and higher rates are usually required.

No residual activity

Glyphosate is effective on actively growing weeds, but has no residual activity in the soil. Therefore, multiple applications are required to control weeds that germinate later in the season.

Glyphosate resistance

Widespread use has inevitably led to the selection of glyphosate-resistant weeds, including Canada fleabane, giant ragweed, common ragweed and common waterhemp in Ontario, along with kochia in Manitoba.[4] Annuals tend to be more vulnerable to herbicide resistance as each plant produces high quantities of wind-borne seed. A summer annual, such as common waterhemp produces more than 4.8 million seeds per plant.[5] Glyphosate-resistant biotypes of this weed have been confirmed in Southwestern Ontario (Fig. 2), with 3-way multiple resistance to Groups 2, 5, and 9 confirmed in Essex and Lambton counties.[6]

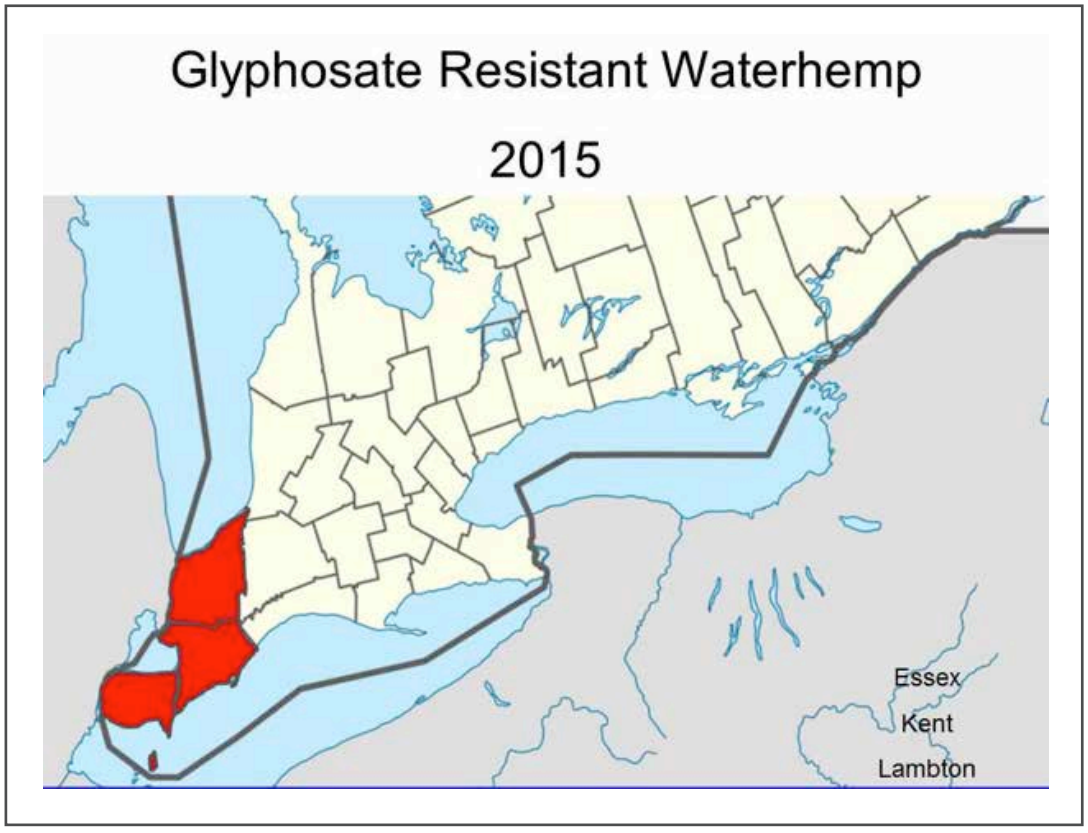

Figure 2. Glyphosate-resistant waterhemp found in 39 fields in Ontario.

Source: Sikkema, 2015[6]

One mode of action isn't enough. Sometimes, not even two.

With Roundup Ready 2 Xtend® dicamba-tolerant soybeans now on the market, growers can apply two modes of action for an effective spring burndown. But careful management and planning are needed to avoid selecting for resistant weeds. If you rely only on dicamba as your additional mode of action, then the selection pressure for grasses lies solely on glyphosate. If glyphosate-resistant weeds are already present in your field, then a tank mix of dicamba and glyphosate will intensify selection pressure on dicamba.

It is important to note that Group 4-resistant weeds already exist in Canada. 2,4-D-resistant wild carrot was first identified in 1957 in Ontario, while Group 4-resistant wild mustard was found in 1990 in Manitoba.[4] Studies from other parts of Canada have confirmed resistance to Group 4 chemistry in common hempnettle, kochia, cleavers and wild mustard. To delay the onset of multiple resistance to glyphosate and dicamba, we need to take an integrated approach to weed management.

Turn to multiple modes of effective action

After the introduction of glyphosate-tolerant crops in Canada in the late 90s, the first documented case of glyphosate-resistant weeds appeared in 2008.[7] To ensure the longevity of this technology, it's important to tank mix with additional modes of effective action in addition to glyphosate.

What makes them *effective* modes of action? With resistance on the rise, a minimum of two herbicide Group chemistries is needed – each with overlapping activity against weeds. For instance, a field with glyphosate-resistant Canada fleabane would require two additional chemistries *other than* glyphosate to meet the minimum requirement. Glyphosate is no longer effective on this particular biotype, so tank mixing with a herbicide that contains Group 4 and/or Group 14 chemistry (such as Eragon® LQ, Integrity® or Optill® herbicides) would be a good option. It's less likely for a weed to develop resistance to multiple chemistries at once. Be sure to rotate your modes of action between pre-plant/pre-emergence, post-emergence and post-harvest.

Use soil-applied residual herbicides

Using a herbicide with residual activity will decrease the pressure on your in-crop herbicide. While your initial burndown targets emerged weeds, soil residual activity will manage later emerging ones. This decreases weed pressure during the critical period for weed control, allowing for more uniform crop emergence and maximizing your yield potential. Using residual herbicides is especially important for wide-row soybeans, where canopy closure tends to take longer.

Tillage.

Tillage is a non-herbicidal strategy for weed control, provided the weeds are small and uprooted entirely. In contrast, vertical tillage is a good method for preparing the seed bed, but less so for weed control. Winter annuals and perennials can be tough to control with spring tillage as they're much more established by then, so other methods of weed control must be used prior to tillage.

Diverse crop rotations

Rotate into different types of crops (e.g. corn-soybean-wheat) to take advantage of alternative chemistries and use them to control different weeds at different times of the year. Consider planting cover crops either inter-seeded or after your wheat crop. Not only do they protect the soil from wind and water erosion, they also suppress weed growth.

As with any integrated management plan, it's important to use a combination of herbicidal and non-herbicidal strategies. This includes crop rotations, row spacing, planting cover crops, using clean equipment and scouting both before and after a herbicide application. Having a dicamba-tolerant system may add to the flexibility of your application. However, we need to be proactive in managing this technology, so we can continue using this tool for the next several years.

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