The unintended consequences of higher spraying speeds

Should we be rethinking how we spray our fallows in Summer?

Bill Gordon
Bill Gordon Consulting Pty Ltd
PO Box 4197
Lawrence NSW 2460
bill.gordon@bigpond.com

Introduction

It has been over a decade since I first started promoting coarse droplets (and larger) applied through air induction nozzles for summer fallow spraying, in an attempt to help minimize spray drift.

At that time we demonstrated that good efficacy could be achieved for a range of translocated products like Glyphosate in the low stubble cotton systems that were typical at that time. Our travel speeds were typically lower, less than 20-22 km/h, and our application volumes were often around 50L/ha for translocated products during summer.

Since that time, stubble retention in many fallows has increased, the weed spectrums we are targeting have changed, and spraying speed for fallows has generally increased. These changes, combined with the use of larger droplets, have had two unintended consequences. The first impact is related to deposition and efficacy, particularly when operating at higher travel speeds. The second impact is related to the level of risk applicators are prepared to take when they spray, by assuming that using larger droplets will stop spray drift.

This article considers what is required to maintain the balance between achieving good efficacy and the need to eliminate large spray drift events.

The impacts on efficacy when spraying speed is increased

Good timing, a robust rate of product and a suitable water rate are all crucial factors for obtaining efficacy. However, efficacy is not only about producing enough droplets to cover the intended target, it is also about getting the droplets to land (and stay) where you need them.

Where a droplet will land is affected by its size, its velocity (speed), the prevailing air movement and the formulation or adjuvant effects. These are all factors that can affect the deposition of droplets onto a target when spraying occurs at higher speeds (km/h in the mid to high 20's or above).

Higher travel speeds during spraying introduce new problems, including:

- More horizontal (forward) movement of large droplets, resulting in more shadowing or misses of smaller weeds in and around crop and behind standing stubble. This is much more noticeable in a head wind–tail wind situation, than a cross wind (across the rows).

- Poorer penetration of stubble and larger grass weeds by droplets at the larger end of the coarse spectrum (or coarser). This is a function of the droplets ability to penetrate the stubble (without being intercepted by it), as well as number of droplets produced as the droplet size increases. Moving from the small end of the coarse spectrum (towards medium) to the larger end of coarse (towards very coarse) can reduce the number of droplets produced by a factor of up to three times.

- Higher travel speeds cause the tyres to displace more air, moving droplets away from the wheel tracks. This contributes to poorer wheel track control.

- Increased travel speeds increase the wake effect (air movement) around machine, particularly around the wheels and in the centre of the sprayer. This air movement reduces deposition in these spots and increases the upwards 'suction' behind the sprayer, which increases drift potential. The wake effect produced by self-propelled sprayers travelling at higher speeds is most noticeable on the deposition of spray droplets on the downwind side of the machine, especially in standing stubble adjacent to the wheel tracks.

- Most importantly, higher travel speeds can result in reduced retention of larger droplets onto grasses and other hard to wet leaf surfaces. This problem may be increased with the addition of some oil based adjuvants, especially when used with air induction nozzles operated at the larger end of the coarse spectrum, where the adjuvant can collapse the air within the droplets.

Some of these impacts can be addressed with sprayer setup (wheel track nozzles for knock down herbicides), nozzle selection (spray quality) and the choice of adjuvant.

Application parameters that will improve efficacy when travelling at higher speeds

- Operating nozzles that produce droplets at the smaller end of the coarse spectrum (towards Medium).

- Reducing the nozzle spacing from 50 cm to 25 cm (which may not be practical at lower application volumes due to nozzle blockages when orifice size is reduced). Where it is not practical to have a narrower spacing on the whole boom, consider using a narrower spacing around the centre of the machine and adjacent to the wheels.

- Using wheel track nozzles (increased nozzle size for increased flow) adjacent to the wheels (not just on the wheels themselves, but out for 1-1.5 m either side), but only for knock-down, or non-residual products in fallow situations.

- Increasing water rates to around 70-80 L/ha (even for translocated products) where speeds (km/h) are in the mid 20's or higher.

- Operating in a cross wind situation, where possible.

- Maintaining boom height to achieve at least a double overlap.

Unfortunately many of the factors that tend to improve efficacy at higher travel speeds also contribute to an increase in the likelihood of spray drift occurring, particularly during the wrong conditions for spraying.

Spray drift risk and the weather

The risk of off target movement of product that is associated with all spraying activities is governed by how much product we leave in the air, either as droplets or as vapour.

Careful product selection can minimize the vapour component, but what can happen to any droplets that remain in the air after they have been released is purely a function of the weather conditions during spraying, and for several hours after the spraying has taken place.

Most of the damage we have seen in recent years as a result of spray drift has been attributed to the movement of airborne droplets as a result of spraying under the wrong conditions, which nearly always occur at night.

Air movement at Night is more dangerous than air movement during the Day

In terms of spray drift risk daytime spraying is always safer, particularly when the sun is heating the ground and the wind speed is consistently above 3-4 km/h. This is because air movement over a warm surface tends to be more turbulent, which helps air to mix and brings airborne droplets back to the surface.

Spraying at night when the ground has cooled, and surface temperature inversion conditions are likely to exist is dangerous because the air flow across the surface becomes less turbulent and more laminar (where the air flow becomes parallel to the ground). Typically wind speeds less than 11 km/h at night will be laminar, which can lead to droplets remaining suspended in the air for long periods of time. These droplets will continue to move with that airflow until the inversion breaks some time after sunrise.

In a single, un-replicated, drift study conducted in the Summer of 2011, which compared the amount of drift produced from daytime spraying versus night time spraying, the amount of chemical remaining in the air after spraying at night was 5-6 times greater than that which occurred from spraying after sunrise. The amount of chemical remaining in the air from less than 1 hour of spraying at night spraying was equivalent to 1 hectares worth of chemical for every 60 hectares that were sprayed at night, even when using a coarse spray quality.

The Balancing Act: Efficacy versus Drift Potential.

The point of summer fallow spraying is to control the target weeds. We do this to conserve moisture, retain nutrients and to reduce the weed seed bank for future crops and fallows. The more efficient these operations are, particularly in relation to completing spraying while the target weeds are most susceptible, the better the outcome is likely to be.

If the desire is to get over the country as quickly as possible, so we can target weeds while they are most susceptible, this is a valid strategy. However with increased speed, there is usually a need to reduce droplet size to the smaller end of the coarse spectrum to maintain efficacy. This will increase drift risk, particularly if the conditions are wrong.

In my view, this means that the only safe time to spray when travelling at higher speeds is during daylight hours, when the sun is clearly up and heating the ground, the wind speed is above 3-4 km/h, and a suitable downwind buffer exists.

Until our understanding of air movement at night improves, Night spraying should be considered to be too high a risk for spray drift.