WEED CONTROL IN WHEEL TRACKS
FACT SHEET

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

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Improving weed control in wheel tracks during summer fallow spraying

Reduced travel speeds will generally decrease the level of dust raised by the sprayer to increase spray performance.

KEY POINTS

- Poor control of weeds in the sprayer's wheel tracks and the adjacent areas during summer fallow applications can be the result of poor spray deposition, excessive dust, or a combination of the two.
- Using additional wheel-track nozzles for knockdown herbicides (non-residual) can improve deposition and the level of control in the wheel tracks and adjacent areas.
- Generally, dust is only reduced when soil moisture is present, speed is reduced or more permanent wheel tracks are used.

Factors contributing to a reduced level of weed control in the wheel tracks

Poor weed control in the wheel tracks of the sprayer can result from a number of factors, such as those listed below, which often interact with each other.

- The additional stress placed on the weeds due to the physical damage from being run over. This leads to poorer uptake and translocation of many products.
- Poor deposition of spray, resulting from droplets being pushed away from the wheel track by air displaced by the sprayer's tyres. This effect increases with higher travel speed, wider tyres and more aggressive lug patterns.
- More dust produced by higher travel speeds and dry soil can interact with many products on the leaf surface (such as glyphosate and paraquat), potentially reducing their efficacy.

These factors should not be confused with secondary germinations of weeds that may occur shortly after the application.

Secondary germinations are a result of increased contact between the soil and the weed seed when the weight on the sprayer's tyres acts to produce a 'press wheel' effect on the soil. Careful monitoring of weed germinations after an application, particularly in the wheel track, is required to determine if this is contributing to apparent poor control.

Timing of sprays and drift potential

It is common for many spray operators who have problems with dust during summer fallow spraying to spray when the wind speed is low and the soil surface is moist. Spraying after a rainfall event, provided the target weeds are not too wet, can result in excellent weed control.

However, many spray operators also make applications during periods of low wind speed immediately after an early morning dew event and after a clear night. Unfortunately this is also a time where there is a very high risk that a surface temperature inversion will be present, and in many instances spraying at this time would be illegal due to the spray drift restraints found on many product labels.

Australian Pesticides and Veterinary Medicines Authority advice suggests that growers should anticipate that a surface temperature inversion is present every night unless one or more of the following are present:

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- heavy, low level cloud;
- rain; or
- the wind speed remains above 11 kilometres per hour for the entire period between sunset and sunrise.

In situations where a surface temperature inversion has formed overnight, it is recommended that spraying is delayed until after sunrise, where the sun is at least 20 degrees above the horizon and the wind speed has consistently been above four to five kilometres per hour for at least 30 to 45 minutes.

Ways of minimising dust and its effect on product performance

Reducing travel speed

Higher travel speeds generally increase the level of dust raised by the sprayer. For most sprayers the level of dust produced increases as speeds rise above 14 to 16km/h.

The affect of aerodynamics around the machine also increases with higher travel speeds due to a wake effect, which causes lift directly behind the sprayer. This has the potential to increase the amount of dust raised by the sprayer and the distance that the dust will travel.

Deposition directly behind the sprayer can also be affected by travel speed. Lower ground clearance and smaller droplets lead to reduced deposition of spray between the wheels on many sprayers, particularly when traveling into the prevailing wind direction.

At equivalent travel speeds and spray qualities, the higher clearance self-propelled sprayers tend to produce better deposition between the wheel tracks than lower clearance trailing spray rigs, however, dust still remains a problem when the travel speed is too high for the conditions.

Use a robust rate of product

In situations where dust is expected to interact with your products it is always a good idea to use a robust rate of product. Ensure that this rate is consistent with the legal requirements on the product label.

Utilise permanent wheel tracks

Many operators that have moved to more permanent wheel tracks (controlled traffic or tram tracks) have reported a reduction in the levels of dust produced when spraying. This is a particular advantage of chaff tram lining where the chaff fraction is dropped onto permanent wheel tracks. While this can improve the level of control achieved, applicators still need to address the issue of reduced deposition due to air movement shifting droplets away from the tyres.

Mudguards and mudflaps

Design factors such as mudguards and mudflaps tend to reduce the amount of air displaced by the tyres and can suppress or reduce how far dust may travel out of the wheel track. However, there will be limits on the travel speed at which they remain effective, which is likely to change between sprayer types and spraying conditions.

Mudguards and mudflaps by themselves are not likely to solve the problem of poor deposition of spray in and around the wheel tracks. They should be used in combination with wheel-track nozzles and the other factors discussed in this Fact Sheet.

Adjuvants and water conditioners

Often the addition of water conditioners such as ammonium sulfate and acidifying and buffering agents can reduce the level of interaction between some products and dust. Always ensure that any adjuvants used for this purpose are compatible with the tank mix and are approved on the product or adjuvant label for use in the situation in question.

FIGURE 1 A TTI-60 nozzle suitable for applications containing 2,4-D products.

Ways of improving deposition in and around the sprayers wheel tracks

Wheel track nozzles

The most common method for improving deposition around wheel tracks with knockdown herbicides is to use wheel-track nozzles. Most applicators place a larger orifice nozzle (Twin Nozzles, or twin caps with appropriate nozzles fitted) directly behind the wheel (see Figure 1).

Larger orifice nozzles increase the flow rate (amount of product), and often droplet size, directly behind the wheel itself. This can be very effective in situations where the machine travels directly with and into the wind. However, increasing the flow in a single position does not always improve deposition in a cross-wind situation.

If using a 50-centimetre nozzle spacing, it may be worth considering using narrower nozzle spacings (25cm) behind and adjacent to the wheels to increase the potential deposition in the areas adjacent to the wheels.

The nozzles directly behind the

FIGURE 2 Typical of a higher clearance sprayer in a cross-wind situation.

wheel should still have an increased flow compared to those on the boom. Additional nozzles fitted to either side of the wheel that utilise narrower spacings can be of a smaller orifice size than the other nozzles, provided that the spray quality is at least the same or coarser than that stipulated on the label.

Higher clearance sprayers

Higher clearance machines still have issues with wheel tracks in summer fallow situations (see Figure 2). However, the extent of the problem may not be as great as a lower clearance trailing sprayer at comparable speeds (see Figure 3).

All machines will increase the level of dust raised as you increase speed.

Wider wheel spacings

Wider wheel spacings on higher clearance machines do not appear to impact on the level of dust or deposition produced in and near the wheel tracks.

Front-mounted booms

Front-mounted booms can provide improved deposition in and adjacent to the wheel tracks, provided speed is not excessive. At higher speeds (typically above 25km/h), the air displaced forwards by the front tyres can push droplets away from the wheel track.

The issues of plant stress, dust and secondary germinations are present whether the boom is front mounted or rear mounted. Hence, additional wheel-track nozzles are still useful for improving deposition in the wheel tracks for non-residual products.

Spray quality

Increasing the droplet size by using coarser spray qualities tends to reduce the total amount of spray displaced by the aerodynamic effects of the machine and the tyres. However, by increasing droplet size we also reduce the number of droplets produced for each litre of spray, which can reduce the evenness of the spray deposit unless the application volume is increased by using a larger orifice size behind the wheels.

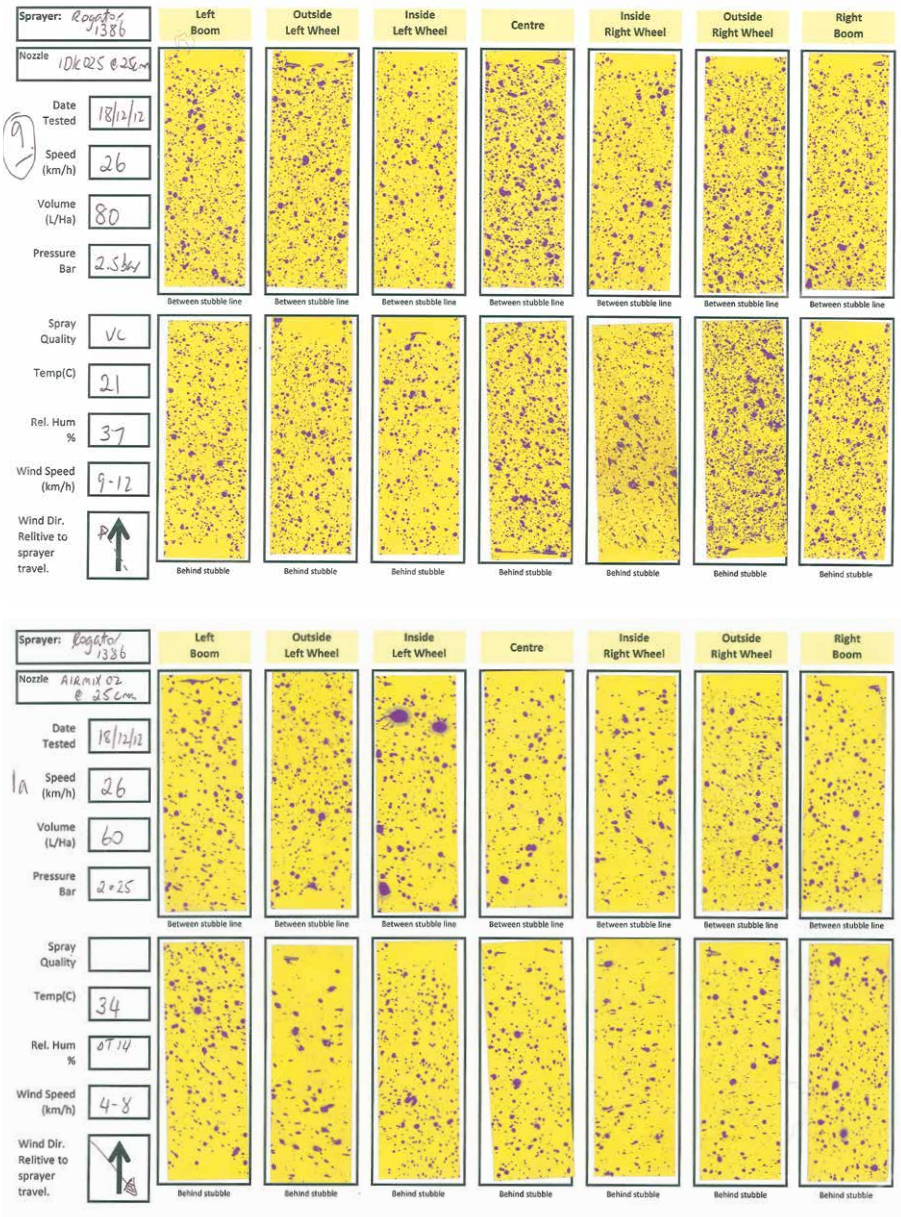
In situations where deposition in and around stubble is required, greater deposition within the stubble is often achieved by operating in the middle of the coarse spectrum.

To maximise deposition in and adjacent to the wheel tracks, a combination of droplet sizes close to wheels (from the large end of coarse spray quality to the smallest end of coarse spray quality) is most likely to provide the best deposition.

Where products containing 2,4-D are used and a very coarse spray quality or larger is required, an increase in the application volume may be required to maintain or improve efficacy.

FIGURE 3 Typical of a low clearance trailing sprayer in a head wind situation.

FIGURE 4 Deposition between rows and behind stubble for two application volumes (80L/ha, top and 60L/ha, bottom).



Application volume

Often, increasing water rates during dusty conditions, combined with using a robust rate of product, can be beneficial.

Nozzle selection for higher water rates should be given careful consideration in order to avoid operating at very low pressures with air induction nozzles; or selecting nozzle types that produce droplets that are too coarse for the target, the product's modes of action or the application volume selected.

The two images displaying water-sensitive paper (see Figure 4, page 3) compare deposition between the rows and behind stubble at two application volumes. The machine used has a 25cm nozzle spacing, but at 60L/ha we can see reduced deposition in the stubble line adjacent to the right wheel. Increasing the application volume to 80L/ha has greatly increased coverage, particularly in the stubble line and adjacent to the wheels. This is particularly important when using contact-type herbicides.

Summary

Improving deposition in the wheel-tracks requires the operator to consider many factors. The most useful thing growers can do is to utilise additional wheel track nozzles when using knockdown herbicides.

The best way to assess deposition in and adjacent to the wheel-tracks on a sprayer is to use a fluorescent dye or water-sensitive paper.

Make your own comparisons of the impact that changes in spray quality, application volume, travel speed, wind direction and manipulating nozzle types on the wheel tracks have on spray deposition.

FREQUENTLY ASKED QUESTIONS

When is the best time to spray to reduce the impact of wheel tracks?

The impact of wheel tracks will always be reduced when the soil is moist and wind speed is not excessive. However, timing of application must take into account the likelihood that a surface temperature inversion may be present, particularly in the hours leading up to and immediately after sunrise when the wind speeds are relatively low.

Why are my wheel tracks worse with a head wind?

Many sprayers, particularly the lower clearance trailing rigs, create lift behind the sprayer. This reduces deposition of spray directly behind the sprayer, particularly into a head wind. Although additional nozzles or larger nozzles on the wheel tracks and centreline of the sprayer may improve control with knockdown herbicides, reducing travel speed is one of the few solutions to this problem.

Can I add anything to the tank to reduce the impact of wheel tracks?

For some herbicides the addition of ammonium sulphate and acidifying or buffering agents that reduce herbicide interactions with cations may improve control in dusty situations. However, this will not completely solve the problem. Factors such as spraying speed, wheel track nozzles and firmer wheel tracks are likely to have a bigger impact on control in the wheel tracks than additives to the tank. If considering using adjuvants, always ensure they are used in accordance with the product labels and adjuvant labels, and are registered for this purpose.

USEFUL RESOURCES

Surface temperature inversion **Fact Sheet**
www.grdc.com.au/GRDC-FS-SprayInversions

'Adjuvants: Oils, surfactants and other additives for farm chemicals'**, GRDC**
www.grdc.com.au/GRDC-Booklet-Adjuvants

Graeme Tepper, *'Weather essentials for pesticide application'*, GRDC
www.grdc.com.au/GRDC-Booklet-WeatherEssentials

MORE INFORMATION

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