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IN-CROP HERBICIDE USE FACT SHEET

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NORTHERN, SOUTHERN AND WESTERN REGIONS

APPLICATION CONSIDERATIONS FOR IN-CROP HERBICIDE USE

KEY POINTS

- Knowledge of a product's translocation and formulation type is important for selecting nozzles and application volumes.
- Evenness of deposit is important for poorly or slowly translocated products.
- Crop growth stage, canopy size and stubble load should influence decisions about nozzle selection, application volume and sprayer operating parameters.
- Robust rates of products and appropriate water rates are often more important for achieving efficacy than the nozzle type, but, correct nozzle type can widen the spray window, improve deposition and reduce drift risk.
- Travel speed and boom height can affect efficacy and drift potential.
- Appropriate conditions for spraying are always important.

Table 1 A summary of herbicide groups and the properties that interact with spray practice

Group	Active constituents	Uptake	Translocation	Site of action	Metabolism	General physical mixability*	Notes
A (fops)	clodinafop-propargyl + cloquintocet-mexyl, diclofop-methyl, haloxyfop	Slow	Slow	ACCase – grass meristem	Variable	Not with Group I	Coverage is important, selects for resistance rapidly
A (dims)	traloxydim, clethodim, sethoxydim	Slow	Slow	ACCase – grass meristem	Variable	Not with Group B	Adjuvants required; degrades rapidly in sunlight; water quality, selects for resistance rapidly
B (imidazolinones)	imazethapyr	Moderate	Phloem/xylem	Acetolactate synthase – meristem	Selective	Not with Group A (Dims)	Very reliable, selects for resistance rapidly, soil pH important for residues (increases with low pH)
B (sulphonlyureas)	chlorsulfuron, iodosulfuron-methyl-sodium, triasulfuron	Moderate	Phloem/xylem	Acetolactate synthase – meristem	Selective	Not with Group A (Dims)	Very reliable, selects for resistance rapidly, soil pH important for residues (increases with high pH)
B (sulfonamides)	flumetsulam	Moderate	Phloem/xylem	Acetolactate synthase – meristem	Selective	Mixable	Very reliable, selects for resistance rapidly, limited soil residual
C (triazones)	atrazine	Soil and foliar	Xylem	Photosystem II	Selective	Not with Group A	Requires sunshine for good activity, organic matter determines soil activity
C (triazinones)	metribuzin	Soil and foliar	Xylem	Photosystem II	Selective	Do not mix with Group A	Small weeds only, coverage is required
C (nitriles)	bromoxynil	Foliar	Xylem	Photosystem II	Selective	Mixable	Reliable in most environments
D	pendimethalin, trifluralin	Soil only	Almost none	Cell division	Selective	Not mixable	Efficacy is reliant on even soil incorporation soon after application; volatile – gas loss an issue
F	diflufenican	Foliar/soil	Limited	Carotenoid biosynthesis	Selective	Mixable	Good coverage is important
G	carfentrazone-ethyl	Foliar	Limited	Chlorophyll/Photosystem II	Selective	MCPA	Works better under warm conditions
I	2,4 D, MCPA, dicamba, fluroxypyr, clopyralid	Foliar and some soil	Phloem/xylem	Growing points	Selective	Mixable with Group A (Dims)	Reliable in most environments, does not mix well with Group A (fops), except Topik®
L	paraquat	Foliar only	Limited	Photosystem I	Non-selective	Not mixable	Coverage is required, poor control of large weeds
M	glyphosate	Foliar only	Phloem/xylem	EPSPS	Non-selective	Yes	Avoid dust and dirt or Ca, Mg water
N	glufosinate-ammonium	Foliar only	Limited	Glutamine synthetase	Non-selective	Group A	Coverage is required, poor control of large weeds

*always refer to the specific product label for compatible mixing partners, always follow label directions

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Know how a herbicide works

Knowledge of how a product enters the plant and how it is translocated is important for determining the most appropriate application volume, adjuvant type and nozzle style.

Uptake, translocation and application volume

Products that have a slow uptake or slow or limited translocation (such as Group A herbicides) should be applied at higher water rates (typically 70-100L/ha in cereals and higher in many pulses).

Products that are phloem and xylem transported (such as Groups B, I and M herbicides) can often be applied at lower application volumes – 50-70L/ha in low stubble situations and small crop canopy – but normally need to be applied at 70L/ha or more where high stubble loads exist or the crop canopy is dense. Always check product labels and the manufacturer's technical information for specific advice about appropriate application volumes and timing in relation to a crop's growth stage.

PHOTO: BRAD COLLIS

Ensure the nozzle type and spray quality match the product type and label requirements.

Water volume and spray quality

Depositing droplets onto foliar targets is a numbers game. Increasing application volumes produces more droplets, which usually increases the evenness of the application, provided droplets reach where they are required.

Anything that is situated between the nozzle and the desired target weed, such as stubble or a large crop canopy, has the potential to intercept spray droplets. Where crop canopies are large or stubble load is heavy, it is always advisable to use robust or higher water rates.

More droplets can be produced by decreasing the droplet size. However, fine spray qualities do not penetrate dense canopies as well as medium spray qualities from non-air induction nozzles or air-inducted coarse droplets (unless they are used with an air-assisted spray system). Finer spray qualities also increase spray drift risk and are likely to be intercepted by stubble when the load is high.

Adjuvant choice

Choosing the most appropriate adjuvant can improve efficacy, whereas the wrong adjuvant choice may reduce it.

Non-ionic surfactants will generally improve droplet spread on the leaf surface and normally will not adversely interact with products. However, a non-ionic may not improve product performance in situations where an oil-based adjuvant is recommended due to the way oil-based products are absorbed into the plant.

Oil-based adjuvants are usually mixed with oil-based formulations, some emulsifiable concentrates and some low volatile ester-based formulations. The addition of oil-based surfactants to water-soluble products such as glyphosate is not recommended by most manufacturers.

Always check the label recommendations and the manufacturer's recommendations about the most suitable adjuvant for mixing with a particular product.

Interactions between nozzle type and formulation or adjuvants

When it comes to choosing a nozzle, select the nozzle size to deliver the

PHOTO: BRAD COLLIS

Test controller settings and nozzle performance well before cropping starts.

desired volume, but choose the nozzle type to produce the desired pattern and spray quality.

Most products labels will suggest either a medium or larger spray quality, or a coarse or larger spray quality.

When a medium spray quality is required, it is often best to do this with a standard pre-orifice (low drift) nozzle or a larger orifice flat fan (capable of producing a medium spray quality). This is particularly important where labels specify that only a medium spray quality can be used, or when oil-based formulations or adjuvants are to be used.

In some instances oil-based formulations and adjuvants have the ability to collapse the air within the droplets produced by air-induction nozzles, especially when they are operated at the lower end of their pressure range and the spray quality approaches the larger end of the coarse spectrum (towards very coarse).

This becomes an issue when speeds are reduced at the ends of paddocks, around trees and over contours, when the automatic rate controller reduces the pressure to maintain the application rate. Using the **minimum hold** (or lower limit function) in the controller can reduce this, but can also encourage overdosing leading to crop damage.

In some instances using larger headlands can help to **reduce overdosing**. In other situations where larger headlands cannot be achieved, a small increase in application volume can reduce the speed at which the minimum hold engages, which reduces the amount of overdosing.

At the higher end of their operating pressure some air-induction nozzles that produce air-filled medium droplets have the potential to produce more driftable droplets than medium droplets from non-air inducted nozzles, especially when non-ionic wetters are added. This compares a medium droplet with air in it to a liquid only medium droplet and also considers their exit velocity, fan angle and detrainment effects.

Travel speed and nozzle design

Travel speed and nozzle design can affect coverage and the evenness of application. With standard nozzle patterns that face straight down, as travel speed increases the net droplet movement is often in a forward direction, which can result in more droplets depositing on one side of the weed, or increasing retention on stubble. The use of offset (angled) nozzles or twin designs can improve the evenness of deposition, provided the travel speed is not excessive.

Efficacy-based trials in fallow have shown that a number of angled and twin designs perform well at speeds up to 21km/h. Overseas efficacy-based trials have also shown more even deposition from angled or twin nozzles compared with standard patterns that face directly downwards.

Other important factors

Other factors that are important for application include:

- maintaining **boom height** to achieve double overlap at the top of the stubble or crop canopy;
- when using Group I, Group M and Group A products ensure that the **water quality** is suitable;
- ensure the correct **mixing order** for tank mixes;
- only spray under **suitable weather conditions**, where daytime wind speeds are above 3km/h and away from sensitive areas and not exceeding the maximum wind speed on the product label; and
- **do not spray if surface temperatire inversions occur.** Check weather forecasts and spray advice services for inversion risk.

FREQUENTLY ASKED QUESTIONS

Can I use the same nozzles for all of my in-crop applications?

Often it is difficult to use just one set. Some early-season Group I applications will require a coarse spray quality, while some grass sprays may require a medium spray quality (typically at a higher volume).

Sometimes one nozzle type can achieve this but the difficulty presented is in ability of the speed range available from one nozzle to maintain the desired spray quality. Often it is better to have two sets, one set that holds a coarse spray quality, such as an air-induction, and another set that holds a medium spray quality (not air-inducted) when using some oil-based formulations and adjuvants.

Why do I get poorer grass control at the ends of runs?

This can happen with some nozzles, particularly air-induction where the spray quality becomes too coarse and the fan angle too narrow. This is due to the rate controller reducing pressure as the sprayer slows down. This is particularly noticeable when using oil-based formulations and adjuvants and when the spray quality approaches very coarse.

Using the minimum hold function, higher water rates and bigger headlands can all help to reduce the problem.

My in-crop grass control is not as good as it used to be when I used smaller droplets. What can I do?

The level of control can be influenced by a number of factors and it is difficult to compare control across seasons due to changing environmental conditions between them.

Factors such as tank mix partners, water quality, adjuvant selection, the addition of some foliar fertilisers, mixing order and selection pressures on weed populations over time can all have an impact on efficacy.

If you are concerned about the application, it is always a good idea to make side-by-side comparisons by doing some test strips to evaluate your nozzle performance. It is important to record when control is less than expected. Try to prevent seed-set and monitor the paddock closely for potential resistance issues.

USEFUL RESOURCES

Linda Hall, Hugh Beckie and Thomas M. Wolf, 'How herbicides work: biology to application', Alberta Agriculture, Food and Rural Development (Canada), 1999

'Adjuvants: Oils, surfactants and other additives for farm chemicals' www.grdc.com.au/GRDC-Booklet-Adjuvants2012

GRDC Fact Sheets
Surface temperature inversions, Spray mixing requirements, Spray water quality, Spray equipment

Ground Cover Direct
Free Phone: 1800 11 00 44
ground-cover-direct@canprint.com.au

GRDC Back Pocket Guide
Nozzle selection for boom, band and shielded spraying
www.grdc.com.au/GRDC-BPG-Nozzle-Selection

MORE INFORMATION

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