

HERBICIDE BEHAVIOUR FACT SHEET

Mixing knockdown partners with Group G herbicides

The use of Group G (PPO inhibitor) herbicides prior to planting has become a common practice in many paddocks across Australia.

A common use pattern is to apply a relatively low rate (sometimes called a 'spike rate') of the Group G herbicide in combination with another non-selective herbicide. Many of the Group G herbicides registered in Australia support this use pattern on their label.

Reasons for mixing Group G herbicides with a knockdown herbicide include:

- Enhanced control of certain weeds which are particularly sensitive to the Group G herbicide.
- At the rates of the Group G herbicide that are applied via this use pattern there is often no, or minimal, soil residual activity. Planting can usually commence soon after application

(although always check individual labels for any plantback restrictions as this does vary with some products for certain crops, especially canola).

- Rapid brownout. Glyphosate symptoms can take days or weeks to appear. Group G herbicides are very fast acting. Fast visual effects are usually observed within a day or two following application of the tank mix. When applied at these fallow application rates, most Group G herbicide labels require a partner knockdown herbicide to achieve robust levels of weed control.

Sharpen® (saflufenacil) and Valor® (flumioxazin) and some carfentrazone products are the only Group G herbicides to also support a labelled use pattern for fallow weed control when applied as a stand-alone application.

EXAMPLES OF GROUP G HERBICIDES USED IN FALLOW

Active ingredient	Example
butafenacil	B-Power®
carfentrazone	various
flumioxazin	Valor®, Terrain®
oxyfluorfen	various
pyraflufen	Sledge®
saflufenacil	Sharpen®

All other Group G herbicides registered in Australia require the mixing of another knockdown herbicide such as a paraquat or glyphosate, when used at these 'spike' rates for fallow weed control.

Points to consider when mixing Group G herbicides with glyphosate

Glyphosate is the most common knockdown herbicide used in fallow in preparation for planting. As such, it is not surprising that many Group G herbicides are applied in combination with glyphosate. While this mix is common, is often effective, and is supported on product labels, the biochemical properties of these different herbicides means that this mixture is a compromise and may potentially have adverse effects on weed control.



Group G herbicides are often used when targeting marshmallow prior to planting winter crops.

PHOTO GARTH WICKSON, SYNGENTA

Rainfastness – All Group G herbicides enter the leaf rapidly, with most Group G herbicide labels claiming a rainfast period of only 1 or 2 hours following application. This is possible, as much of the applied herbicide has already entered the leaf within this timeframe. Conversely, glyphosate is relatively slow to enter the leaf and can, under suitable conditions, continue to enter the leaf cuticle for many hours after application (some glyphosate formulations have better adjuvant packages built into the formulation which may result in faster leaf entry, and hence have reduced rainfast claims). When applying a mix of glyphosate and a Group G herbicide, the required rainfast period should address the needs of the glyphosate partner.

Choice of tank mix adjuvant – When used in fallow, the performance of most Group G herbicides on the targeted broadleaf weeds will normally be enhanced by the addition of a robust adjuvant package. Many Group G labels recommend the addition of a crop-oil-concentrate, esterified vegetable oil or another oil-based adjuvant for fallow applications. Oil based adjuvants are generally not recommended for mixing with glyphosate as they do not enhance the performance of glyphosate and in certain situations, may even reduce performance e.g. reduced glyphosate efficacy is often observed on some summer grass weeds when an oil-based adjuvant is used.

Droplet coverage – Glyphosate requires considerable time on the leaf surface to penetrate the leaf cuticle. Once inside the leaf, it translocates well throughout the plant. Leaf entry of glyphosate will be optimised by applying as a relatively large droplet (that is less prone to evaporation before the glyphosate has had a chance to enter the leaf), along with a higher concentration of herbicide within the droplet (to create a higher concentration gradient across the cuticle). Glyphosate can be very effective when applied as very coarse (VC) or larger droplets with a typical spray volume of 50L/ha being common (higher water rates may sometimes be needed to create enough droplets to ensure adequate coverage on small, narrow upright catching surfaces is maintained i.e. seedling grass weeds in particular).

Most Group G herbicides do not have the right biochemical properties to translocate throughout the plant. For these herbicides to be most effective they require very thorough leaf coverage. As they enter the leaf very fast, droplet evaporation from the leaf surface is less of a concern, but droplet coverage across the surface is more important. This typically means that smaller droplets and higher water rates will result in best control. Typically, a medium (M) or coarse (C) droplet size will be recommended, with preferred water rates often in the range of 70 to more than 100L/ha.

Systemic movement within the plant – Once inside the leaf, some of the glyphosate will enter the vascular bundle and translocate throughout the plant in the xylem and phloem. Typically, glyphosate will continue to concentrate in the roots of plants for a few days after application. This translocation of glyphosate to the roots of weeds is critical to achieving high levels of weed control.

Most Group G herbicides do not have the right biochemical properties to allow them to enter the vascular bundle and translocate throughout the plant in significant quantity. Group G herbicides work by disrupting a biochemical pathway

within leaf cells, so to be effective they need only to penetrate the leaf cuticle and move to individual cells within the leaf. Very good spray coverage is more important than translocation.

Group G herbicides are also very fast acting, so any Group G herbicide that contacts the vascular bundle will rapidly start to destroy the cells within the vascular bundle, thus quickly reducing the plants ability to translocate water, sugars and other materials, including glyphosate.

Of the Group G herbicides that are commercially available in Australia, saflufenacil (Sharpen®) has the best biochemical properties to allow for some level of translocation within the plant. Under certain conditions, useful levels of saflufenacil may translocate throughout the plant before the vascular bundle is damaged.

Weed size – As most Group G herbicides are not well translocated, weeds need to be small at application. When treating larger weeds with these contact herbicides, it is common to see rapid leaf dessication followed by regrowth from the crown, especially where plants have an established tap root. While glyphosate is also more



Group G herbicides provide very fast brownout within days of application.

PHOTO GARTH WICKSON, SYDNEY

effective on smaller weeds, one of the reasons for its widespread adoption is its ability to control larger weeds than most contact herbicides.

In summary – For the reasons outlined, some manufacturers of Group G herbicides caution against mixing Group G herbicides with glyphosate.

Sharpen® WG label – *“Reduction of glyphosate activity on summer grasses may occur from the tank mix, which may result in reduced control of certain grass weeds. If grass weeds are present and their control is important, it is recommended that the highest labelled rate of glyphosate be used for the use situation encountered.”*

Valor® 500WG technical manual – *“During the summer, extreme light intensity can result in antagonism between the modes of action of Valor and its non-selective partner, particularly in hardened or drought-stressed weeds. This occurs because the speed and degree of brownout (necrosis of the leaf) caused by the group G herbicide is too rapid to prevent proper uptake of the non-selective herbicide.”*

The following are common sense measures to reduce the likelihood of mixture antagonism:

- *Spray late in the afternoon when light intensity declines or early in the evening, to allow for maximum uptake and translocation of glyphosate.*
- *Increase the water volume to compensate for evaporation and to promote better coverage and uptake.*
- *Do not apply to water stressed plants, or to larger plants with well-developed root systems.*
- *Simplify the spray mixture; additional herbicides may affect the uptake of glyphosate in other ways.*

- *Always target young, actively growing weeds. The potential for antagonism is higher in salvage situations where tillered grasses and bigger weeds are the herbicide targets.”*

Most Group G herbicides require the addition of a knockdown partner for fallow applications. Tank mixes of glyphosate and Group G herbicides are commonly used, and are often effective, despite some of these interactions discussed above. When considering this mix, be aware of the compromise in application set up and the potential for the mix to reduce the quantity of glyphosate that may be able to fully translocate throughout the plant. This may be more critical in larger weeds or weed populations with low-level glyphosate resistance. The potential for negative interactions with glyphosate will increase with higher application rates of the Group G partner. Applying glyphosate at the upper end of the registered label rate may assist in masking some of these interactions.

What about mixtures with paraquat based knockdowns?

Where suitable, users may wish to consider paraquat or paraquat/diquat herbicides as the knockdown partner for the Group G herbicide. The speed of leaf entry, rainfastness and herbicidal effects of paraquat is as fast, if not faster. Neither herbicide is well translocated, so the preferred application set up needed to achieve excellent leaf coverage is similar for both herbicides. While paraquat does not generally benefit from an oil-based adjuvant it is also less likely to be compromised by these adjuvants. For these reasons, paraquat based knockdowns are likely to be more

biologically compatible with Group G herbicides.

RESOURCES

Congreve, M. and Cameron, J. (2018). Understanding post-emergent herbicide weed control in Australian farming systems - a national reference manual for agronomic advisers. GRDC publication, Australia.

MORE INFORMATION

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