



GLYPHOSATE STEWARDSHIP



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Attention to detail is essential for resistance management

Applied correctly, glyphosate as a non-selective herbicide can deliver very high levels of weed control. As such, it has become one of farmers' most trusted weed management tools. However, experience around the world shows that glyphosate is not invincible, weeds can develop resistance to it.

In January 2025, WRAG announced the first case of glyphosate resistance in the UK in an Italian ryegrass population in Kent. The farm in question has taken steps to prevent the spread of any resistant seed.

Other farms should prevent the development of resistance in the field by following glyphosate stewardship guidance.

In 2021, the Weed Resistance Action Group (WRAG) published updated guidelines to minimise the risk of glyphosate resistance developing in the UK. This booklet guide builds on their recommendations and Bayer's expertise with Roundup (glyphosate) products to give farmers and agronomists an effective framework to ensure the long-term efficacy of glyphosate.



What is product stewardship?

First and foremost, product stewardship is about the safe and responsible use of the product every time you apply it.

But stewardship also means taking steps to ensure the long-term efficacy of a product. Every crop protection active is at risk of resistance but every farmer, agronomist and spray operator have ways to reduce this risk.





Resistance risks

The possibility of glyphosate resistance developing in problem weeds such as black-grass and Italian ryegrass is real and needs to be taken seriously. All of the following increase the chance of it happening.

Population dynamics

High weed populations tend to increase the risk of resistance development. Taking action to drive down numbers reduces the risk.

Lack of diversity in control methods

Reliance on few or only one method of control greatly increases the risk of resistance developing. This applies to chemical and cultural control methods, the more diversity across the cropping cycle, the better.

Repeat applications to survivors

A small number of weeds often survive a herbicide application. In all likelihood, this is not due to resistance but because of application or field effects. In any case, take no chances, ensure survivors are controlled with another chemical mode of action or cultural method. Repeat applications of glyphosate to surviving weeds is a major resistance risk.

Low rates

Insufficient application rate for the target weed and poor application timing means too many weeds survive the application. These surviving weeds are a potential resistance risk and an immediate problem for farmers aiming for clean, high-yielding crops.

Poor application technique

Incorrect sprayer set up and operation can result in under or overdosing the product, affecting performance in the field. In the long term, this can contribute to resistance development. Examples of poor application technique include:

- Poorly maintained machinery which is not routinely calibrated and serviced
- Incorrect selection of nozzles for the job at hand and/or not replaced when worn out
- Operating at the wrong boom height and travelling too fast (+12 km/hr)

Additionally physical losses from drift, run-off and bounce, and chemical losses due to pH, hard water and light degradation can all reduce the quantity of active reaching the target hence causing below par control.

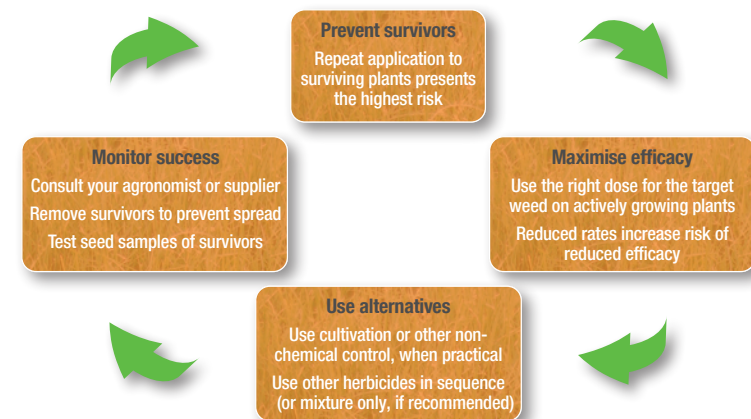
Incorrect timing

Adverse weather conditions and weed growth stage can both impair glyphosate performance. For example, poor downward translocation will occur during the stem extension phase of growth. The natural flow of sugars from photosynthesis in the leaf is upwards to the rapidly extending stem for use in the developing flower head.

Framework for success

Resistance management requires attention to detail, the following framework aims to:

- Reduce weed pressure in the crop and improve yield
- Prevent excessive seed return
- Reduce chances of selection for resistant weeds



Source: WRAG guidelines for minimizing the risk of glyphosate resistance in UK (2021)

Keeping control within the guidelines

Black-grass and Italian ryegrass are high risk weeds for resistance development. They already greatly affect many farmers cropping and weed control strategies. Glyphosate has an important role helping growers manage grass-weed populations, but farmers need to be mindful of glyphosate stewardship and responsible use to help retain effectiveness in the longer-term.

WRAG recommends a maximum of two glyphosate applications after harvest, before drilling the next

crop. This applies equally to autumn and spring sown crops. Between applications, use cultivation to eliminate any survivors.

Where cultivation is not possible or not desirable, for example no-till systems, only one application is recommended after harvest and before drilling

Multiple applications of glyphosate before drilling, such as repeat stale seedbeds to control black-grass are not a sustainable way to use glyphosate.



Maximise performance

Ensure that every glyphosate application achieves the best possible control.

- Use the **appropriate dose rate** for the target weed; for mixed weed populations, tailor dose rates to the hardest to kill weed. (See rate table below)
- **Target small weeds** which are much easier to control than larger well-established weeds
- Partner products (and adjuvants) cannot substitute for an effective dose of glyphosate, **do no cut rates**
- **Optimise application practices:**
 - Ensure spray application machinery is tested in line with legislation, routinely calibrated, including replacing worn nozzles
 - Nozzle choice and droplet size suitable for the target, generally bigger weeds require a coarser spray and larger droplet size
- Water volume, balance achieving a high concentration of active and ensuring full coverage of the canopy
- Appropriate boom height to minimize drift risk, but ensure correct nozzle orientation and spacing to achieve the necessary overlap with adjacent nozzles to deliver a consistent spray pattern across the width of the boom
- Forward speed, higher forward speeds increase the risk drift and turbulence leading to uneven spray deposition; 10-12 km/h is typically a safe forward speed to ensure efficacy
- Aim to apply in conditions which favour best efficacy: warm temperatures (15-25°C) are optimum; avoid periods of prolonged frost; avoid treating immediately ahead of rain events

Recommended Application Rates

Minimum 540 g*	720-900 g	1080 g	1440 g	1800 g
Annual grasses (up to 2-3 leaves) Charlock Cleavers Common poppy Fat-hen Fumitory Groundsel Shepherd's purse	Annual grasses (early tillering) Tough broad-leaved weeds Black bindweed Cut-leaved cranesbill Fool's parsley Polygonums Small nettle Volunteer OSR (up to 6TL)	Annual grasses (late tillering and flowering) Couch up to (75 shoots/m²) Volunteer OSR (>6TL) Short-term grass leys (with annual weeds)	Perennial grass-weeds, e.g. Couch (>75 shoots/m²) Onion couch Perennial broad-leaved weeds Docks Grass leys (with perennial grass-weeds)	Perennial broad-leaved weeds Bindweed Common nettle Creeping thistle Rosebay willow herb Sowthistle Long-term grass leys (with perennial broad-leaf weeds)

* For weed sizes up to 15 cm; apply a higher dose for annual broad-leaved weeds larger than this size

Monitoring:

It is important to monitor the success of the overall herbicide programme and investigate reasons for poor levels of control as an important component of a successful long-term weed management plan.

For further information visit:



The WRAG guidelines
<link to website



Bayer Crop Science
Roundup hub
<link to website





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