



## TEN FACTS EVERYONE SHOULD KNOW ABOUT HERBICIDE RESISTANCE

The Steering Group of WRAG has produced this list of 10 facts that everyone should know about herbicide resistance in grass-weeds (black-grass, Italian rye-grass, wild oats). Whilst they are often over simplifications, this basic level of knowledge is essential in order to develop an effective strategy to manage resistant grass weeds.

1. **ALS and ACCase herbicides pose a very high risk of resistance development.** ALS (e.g. sulphonylurea) herbicides and ACCase (fops, dims and dens) pose a higher resistance risk than other modes of action.
2. **There is confirmed target site resistance to ACCase and ALS herbicides.** If no action is taken target site resistance can quickly become severe and herbicides give no control.
3. **There are no new modes of action or tools about to help resistance management.**
4. **Development of herbicide resistance is within your control.**
5. **Once resistance has developed it does not go away.**
6. **Mixtures or sequences of herbicides with different modes of action are vital to reduce risks.**
7. **Including cultural control options is vital to reduce risks.** Changing herbicide policy alone is unlikely to provide adequate lowering of resistance risk.
8. **Spot resistance early.** It is much cheaper to stop resistance developing so spotting the early signs is vital.
9. **Resistance tests are a valuable management tool.**
10. **Resistance is widespread so act now before it is too late.**

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1. **ALS and ACCase herbicides pose a very high risk of resistance development.** Use of ALS (sulphonylurea) herbicides and ACCase (fops, dims and dens) poses a higher resistance risk than other modes of action. Most currently available ALS and ACCase products are listed in the table below.

Example high resistance risk grass-weed herbicide products					
ALS herbicides			ACCase herbicides		
sulphonylureas	triazolo-pyrimidines	sulfonylamino-carbonyl-triazolinones	'fops'	'dims'	'dens'
Atlantis Hussar Lexus Monitor Pacifica Samson	Broadway	Attribut	Falcon Fusilade Panarex Pilot Ultra Sceptre Topik Warrant	Aramo Grasp Laser	Axial

2. **There is confirmed target site resistance to ACCase and ALS herbicides.** If no action is taken, **target site resistance** quickly becomes severe and affected herbicides give no control. ACCase target site is common and increasing annually. Many cases of ALS target site resistance in black-grass have now been confirmed. By contrast **enhanced metabolism** is slower to develop and is variable in its effects, but is widespread in major arable areas. Some control is usually possible, especially if weeds are sprayed when they are small. Most herbicides, including isoproturon, chlorotoluron and pendimethalin are affected by enhanced metabolism to some degree.
3. **There are no new modes of action or tools about to help resistance management.** No companies have herbicides in their pipelines that will provide new solutions to herbicide resistance within the next few years. It is therefore vital to preserve the herbicides we have. The tools at our disposal are finite.

4. **Development of herbicide resistance is within your control.** Unlike diseases and pests that can spread rapidly across large areas, weeds are relatively immobile. This means that management practices on an individual field or farm will have a direct impact on the way in which resistance develops. Herbicide resistance usually develops within an individual field or farm, rather than be carried in from elsewhere. Field records typically hold the key to understanding why resistance has developed.
5. **Once resistance has developed it does not go away.** Reducing the proportion of resistant weeds is a very slow process, even if no herbicides are used, and takes far longer than would be of any practical management value. Prevention rather than cure is the best option – it is cheaper and more effective.
6. **Mixtures or sequences of herbicides are vital to reduce risks.** Mixtures or sequences of herbicides with different modes of action are vital to delay the development of resistance. The more modes of action you use, the lower the resistance risk. However, mixtures or sequences of herbicides do not prevent resistance – they only slow up the selection process.
7. **Including cultural control options is vital to reduce risks.** Changing herbicide policy alone is unlikely to provide adequate lowering of resistance risk. Continuous winter cropping, minimal cultivations and early drilling encourage grass-weeds, so crop rotation, ploughing, later drilling and higher seed rates are four of the most effective cultural tools. Non-cropping, either by fallowing or set-aside (preferably for two successive years) can be a very effective way of reducing grass-weed populations – provided fresh seed return is prevented.
8. **Spot resistance early.** It is much cheaper to stop resistance developing. Spotting the early signs is vital. First signs might be isolated plants surviving treatment with herbicides or a gradual decline in control over several years. If you see patches of survivors aim to investigate the causes for poor control and remove the patch whilst it is small.
9. **Resistance tests are a valuable management tool.** Tests can identify resistance at an early stage and you can then take prompt action to prevent its spread. Test results will also indicate the mechanism of resistance and help guide you in determining the best herbicide and cultural control strategies.
10. **Resistance is widespread, act now before it is too late.** Resistance does not give you a second chance. Development can be reduced and slowed down significantly. Once you have resistance it is very expensive, reduces herbicide options and does not go away.

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## **About WRAG**

WRAG was formed in 1989 as an informal group of representatives of the British Agrochemicals Association (BAA) (now the Crop Protection Association (CPA)) member companies and other organisations involved in herbicide resistance research. These other organisations include Rothamsted Research, ADAS Limited (ADAS), Chemicals Regulation Directorate (CRD), Universities, Colleges, and the Home-Grown Cereals Authority (HGCA.)

## **The Objectives of Weed Resistance Action Group (WRAG) are:**

- to provide a forum for information exchange between people actively involved in research into herbicide resistance;
- to discuss strategies to avoid resistance and to manage resistant populations;
- to define research needs;
- to discuss test methodology and agree standards;
- to agree statements for the media, whether in response to queries or as unsolicited news releases;
- to maintain communication with similar groups which have been established successfully in other countries.

WRAG is independent but maintains good liaison with the Herbicides Resistance Action Committee (HRAC), which has representation only from the agrochemical industry. WRAG has similar aims and objectives to HRAC, but considers that there is an advantage in having a platform for both independent and commercial interests. A steering group of representatives meets 2-3 times per year, and relevant information is conveyed to all members. Occasional open meetings are also arranged.

## **The steering group currently comprises:**

James Clarke (Chairman) *ADAS UK Limited (ADAS) Boxworth*

Stephen Moss (Secretary) *Rothamsted Research*

Ingrid den Hoed *CRD, HSE*

Mark Ballingall, *Scottish Agricultural Colleges (SAC)*

Paul Neve, *University of Warwick*

Gordon Anderson-Taylor, *Bayer CropScience Ltd*

Steve Cranwell, *DuPont (UK) Ltd*

Iain Ford, *BASF plc*

Jason Tatnell, *Syngenta Crop Protection UK Ltd*

Anne Thompson, *Dow AgroSciences Ltd*

Clare Bend, *Agrii.*