Black-grass: solutions to the problem

Information Sheet 30
Summer 2014

Black-grass.

Latest information

- As of 1 January 2014, the EU Sustainable Use of Pesticides Directive requires priority to be given to non-chemical methods of plant protection wherever possible.
- Multiple-herbicide resistant black-grass now occurs on virtually all farms.
- This Information Sheet provides new information on non-chemical control methods.

Action

- Use several non-chemical control methods, in combination with herbicides, to improve overall control.
- Use resistance tests to find out which herbicides will work on your weeds and to monitor the success of long-term strategies.
- Tailor non-chemical control to each individual field; there is no single 'blueprint' for the best strategy.

Always consider your local conditions and consult a professional agronomist, if necessary.

Why is black-grass an increasing problem?

The majority of black-grass plants now emerge within crops, rather than before drilling when they could be destroyed more easily:

- 80% of black-grass plant emergence occurs in early autumn (August to October)
- More than 50% of winter cereal and virtually all oilseed rape crops are sown before the end of September

Herbicides no longer offer reliable control:

- Multiple-herbicide resistance now occurs on virtually all farms
- No new active ingredients are likely to become available in the near future
- Some existing herbicides may be withdrawn for regulatory reasons

Consequently, relying solely on herbicides for control of black-grass is not sustainable in the long term because of increasing resistance. More non-chemical methods will have to be used in the future.

Herbicide resistance

Occurrence

Herbicide-resistant black-grass has been confirmed in 34 counties in England and has also been detected in Scotland but at a much lower frequency. It is now generally accepted that some degree of resistance occurs on virtually all farms on which black-grass herbicides have been used regularly.

Predicting the impact of resistance on an individual field is difficult because:

- the proportion of plants affected and the type of resistance varies between fields
- some herbicides are more affected by resistance than others

Resistance tests are a valuable management tool. Having weed seed or plant samples tested can help to:

- establish whether herbicides will work on your weeds
- avoid unnecessary use of herbicides
- monitor the success of long-term strategies

Implications

About 97% control of black-grass is required in a non-inversion tillage system to prevent populations increasing.

In the short term, 'stacking' several pre-em herbicides may allow adequate overall control to be achieved. However, as post-em herbicide efficacy falls and resistance to pre-em herbicides increases, it is unlikely that the high levels of control needed from pre-em herbicides will be achieved routinely, especially in dry years (Figure 1).

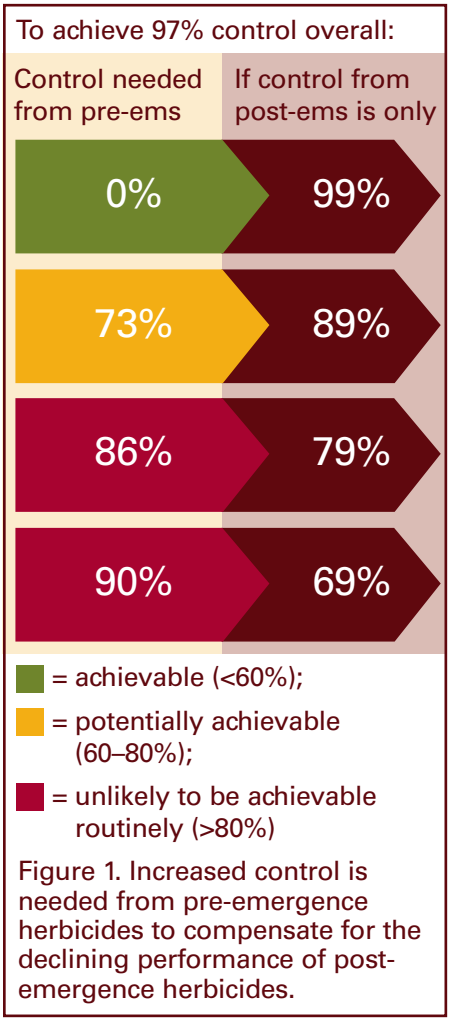

Figure 1. Increased control is needed from pre-emergence herbicides to compensate for the declining performance of post-emergence herbicides.

The agroecology of black-grass

Recognising the importance of these five key factors is essential to the success of any integrated control strategy:

Emergence pattern
– 80% of black-grass plants emerge in early autumn, although the pattern will be affected by seed dormancy

Emergence depth
– Black-grass plants mainly emerge from seeds within 5 cm of the soil surface

Seed longevity in soil
– Average seed decline is 74% per year

Population dynamics
– More than 95% control is needed to prevent weed populations increasing

Competitiveness
– Aim for fewer than 5 surviving plants/m^2 to minimise yield loss and seed return

Non-chemical methods – what level of control can be achieved?

The average levels of control given below are based on a comprehensive review of more than 50 field experiments: P J W Lutman, S R Moss, S Cook and S J Welham (2013), Weed Research, 53: 299–313.

Rotations

The prevalence of autumn-sown cropping is the main reason why black-grass is an increasing problem in the UK.

More balanced rotations are needed on many farms, not just to help in the control of grass weeds, but also to reduce the impact of pests and diseases and to improve soil fertility.

The inclusion of spring-sown crops is likely to be the most beneficial single element.

Re-evaluate crop rotations for long-term sustainability.

Ploughing (69% control)

Ploughing reduces the risk from grass weeds by burying freshly shed seeds to a depth from which seedlings are unlikely to emerge (>5 cm).

Black-grass seeds are relatively non-persistent in the seed bank (70–80% decline per year) so usually fewer old, buried seeds are brought back up to the surface, especially if ploughing is done on a rotational basis, once every 3–6 years.

Shallow non-inversion tillage tends to favour black-grass as freshly shed seeds are retained in the surface soil layer from where plants can readily emerge.

It does, however, avoid bringing large numbers of buried weed seeds back to the soil surface, so is preferable where little seed has been shed in the crop just harvested.

Failure to control black-grass effectively in shallow non-inversion tillage systems can result in a much more rapid increase in infestation (more than tenfold per year) than occurs in systems based on annual ploughing.

Plan cultivation strategy at an individual field level to maximise control of black-grass.

Delayed autumn drilling (>31% control)

Delayed autumn sowing of winter cereals has three benefits:

1. It allows more weed seedlings to emerge and be controlled with cultivations or glyphosate before sowing.

2. Residual pre-emergence herbicides can be 25–30% more effective when applied in later drilled crops because soil conditions are more favourable for good activity.

3. Black-grass emerging in later drilled crops tends to be less competitive and to produce fewer seeds per plant.

These benefits can be achieved by drilling in mid-October (or later if feasible) rather than September but adequate soil moisture is vital to maximise their value.

Delaying drilling carries obvious risks. These can be minimised by having adequate drilling capacity or by using drills that can be used in suboptimal soil conditions.

Delaying autumn drilling can be very effective but the benefit will vary from year to year.

Competitive crops (22–26% control)

The following factors favour competitive crops that are better able to suppress weeds:

- higher seed rates of winter cereals (eg >300 plants/m^2)
- more competitive crops, eg barley is more competitive than wheat
- more competitive varieties
- narrow row spacing
- improved drainage
- good seedbeds
- good agronomy to achieve uniform crops

Competitive crops will help greatly in suppressing black-grass.

Spring cropping (88% control)

About 80% of black-grass emergence occurs in autumn, so spring-sown crops tend to be much less affected and have given a consistently good reduction in weed infestation in field trials.

Spring barley is more competitive than spring wheat but there is a lack of information on the effectiveness of other spring-sown crops and the impact of different spring sowing dates.

Establishing crops in spring can be difficult, especially on heavy soils, and herbicide choice is more limited.

Choose the most appropriate spring crops for the individual farm.

Fallowing/grass ley breaks (70–80% reduction of the seed bank per year)

Seed persistence data and farm experience both support the view that **a one-year fallow or grass ley is not long enough** to reduce high black-grass infestations to acceptable levels.

After two years, less than 10% of seeds are likely to remain – a much more significant reduction. A grass ley break of 2–3 years is also a very good option, provided such fields can be used effectively.

Failure to prevent seed return will greatly undermine the value of a fallow or grass ley break.

The cultivation strategy at the end of any fallow or grass ley break is important. Sufficient time should elapse between cultivating and sowing the next crop to allow the destruction of black-grass seedlings emerging from residual seeds.

Fallowing and grass ley breaks have a valuable role to play in weed control in modern arable systems.

Preventing seed return and spread of resistant seeds

Spraying off patches of black-grass in winter wheat with glyphosate in the first week of June will prevent viable seed return. Consider spraying the same areas for 2–3 years to maximise reductions. Cutting, or spraying in May or later in June, is likely to be less effective.

Minimise spread of seeds and plants in combine harvesters, balers, cultivation equipment, straw or manure.

Hand rogueing is feasible at low weed populations and is particularly recommended in fields where black-grass is only just starting to appear. It may already be resistant if it has been introduced from the main arable areas of England in contaminated straw, for example.

Take action to minimise the introduction and spread of weed seeds.

Integrated Weed Management (IWM)

Reliance on herbicides alone is not a sustainable strategy and, as of 1 January 2014, the EU Sustainable Use of Pesticides Directive (2009/128/EC) requires priority to be given to non-chemical methods of plant protection, wherever possible.

Integrating the use of several non-chemical methods, in combination with herbicides, should improve overall control. Figure 2 shows a theoretical example, based on the values for control on the previous two pages.

In this example, the four non-chemical methods give a combined level of control of 90% (note that this is not simply the sum of the control from the individual methods). Then, assuming that herbicides give 90% control, the overall control in this example is 99% – the sort of level required to prevent black-grass increasing.

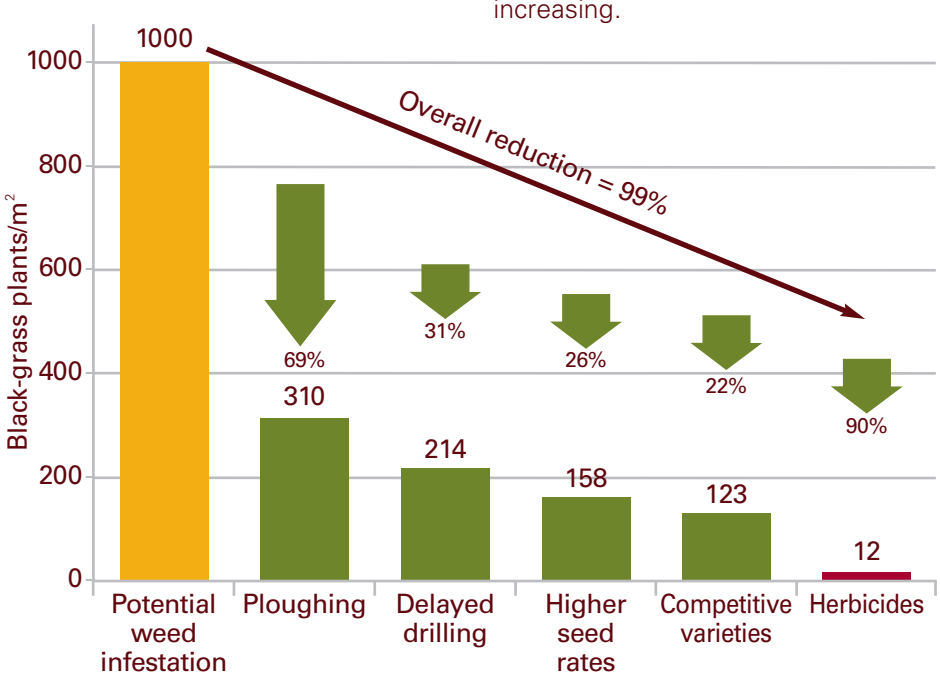

Figure 2. Potential benefit of integrating use of several non-chemical methods with herbicides.

Key messages

- The poorer the control from herbicides, the greater the need for non-chemical methods.
- Integrating the use of *several* non-chemical methods, in combination with herbicides, should improve overall control.
- Recognise that there is no 'blueprint' for the best non-chemical control strategy; approaches need to be tailored to the weed and resistance problem in each individual field.
- Consider the relative cost of controlling black-grass by herbicides and non-chemical methods; herbicides may no longer be the cheaper option on some fields.
- Lack of 'resistance' to non-chemical methods means they should provide more durable control than herbicides; learning how to get the best out of them at the individual farm level will pay dividends in the long term.

Further information

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G61: Managing weeds in arable rotations – a guide (HGCA, 2014)

IS17: Weed control in conventional and organic oats (HGCA, 2012)

TS116: Autumn grass weed control in cereals and oilseed rape (HGCA, 2012)

G47: The encyclopaedia of arable weeds (HGCA/BASF, 2009)

www.hgca.com/weeds

A review of the effects of crop agronomy on the management of *Alopecurus myosuroides*. P J W Lutman, S R Moss, S Cook and S J Welham (2013). Weed Research, 53: 299–313

Black-grass (*Alopecurus myosuroides*) (Rothamsted Research, 2013)

Black-grass: the potential of non-chemical control (Rothamsted Research, 2013)

www.rothamsted.ac.uk/black-grass-and-herbicide-resistance

The benefits of herbicide resistance testing (Weed Resistance Action Group, 2012)

Weed Resistance Action Group

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