**TECHNICAL NOTE TN692** October 2017 • ELEC

# Spring Barley Weed Control

Farm Advisory Service

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## Summary


- **Use integrated weed management techniques to improve weed control, reduce environmental impact, and prevent the development of herbicide resistant weeds**
- **Do not expect large yield benefits from weed control in spring barley, unless the field is very weedy**
- **In many situations weed control is still needed for harvest, grain quality and rotational benefits.**
- **Herbicides should be used carefully. Reductions in dose are possible given the right conditions and small weeds, but keep doses up in very weedy fields or if the crop is uneven.**
- **Most herbicides work best when the crop and weeds are actively growing.**

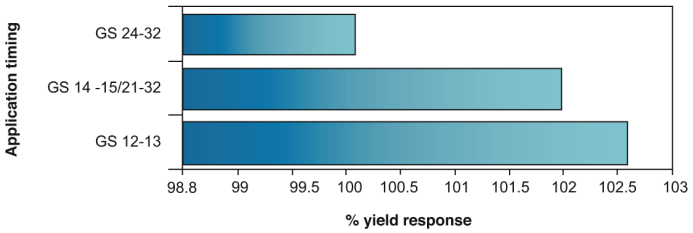
Yield responses to weed control in spring barley are often not large, however, uncontrolled weeds can interfere with harvest, reduce grain quality and build up problems for the future. This note examines an integrated approach to weed management taking account of the rotational benefits of spring barley in dealing with problem weeds. Currently-available treatments are reviewed.


## Cost Benefits of weed control

There is evidence from SRUC trials that yield benefits are relatively small in spring barley grown in arable rotations (Figure 1) and so expensive herbicide treatments are unlikely to be cost-effective.

However, if weed populations are very large as is often the case in traditional arable/livestock rotations, or competitive weed species are present, then good responses are likely. There are ecological benefits to leaving a few non-problem weeds uncontrolled, however there are implications for the weed seed burden in the soil and effect on following crops in the rotation. In vegetable and minor crops there are increasingly limited herbicide options and cereal crops in the rotation can have a cleaning role in reducing the weed seed burden in the soil as herbicide options are greater. Additionally spring barley may be introduced to a winter cropping farm as part of a strategy to deal with problem grass weeds such as black-grass or brome grasses. For this to be an effective strategy minimal seed return from these problem weeds is crucial.

**Figure 1. Yield benefit from herbicide treatment in 38 spring barley trials**




Un-controlled weeds in crops at harvest tend to maintain high moisture levels in the straw and grain, delay harvest, or necessitate the use of a pre-harvest desiccant to assist harvesting. The presence of weeds at harvest will affect the efficiency of combining, and admix in the grain sample. The impact of such delays and grain contamination may affect the marketability of the grain; particularly where higher quality is demanded for malting crops and seed crops.

Nevertheless, it is good ICM practice to minimise herbicide use where possible.

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### The relative competitiveness of weeds

There has been little recent research on the relative competitiveness and impact on yield of weeds in spring barley, but work funded by the Department of Agriculture, Environment and Rural Affairs (DAERA), observations in historic SAC trials, plus figures puplished for wheat winter wheat, indicate the following order of competitiveness for common weeds:

| | Most competitive |
|---|---|
| Wild-oats | |
| Charlock | |
| Corn marigold | |
| Poppy, Fat-hen, Fumitory, Mayweeds, Chickweed, Redshank, Knotgrass | |
| Deadnettles, Speedwells, Field Pansy, Annual Meadow-grass. | |
| | Least competitive |

Some weeds that are very competitive in winter wheat, such as cleavers and black-grass, may be found in spring barley, but are much less competitive than in winter crops. However, the aim should be to optimise their control as part of the integrated rotational control strategy.

Nevertheless, there are often un-competitive weeds present in spring barley at populations that do not justify targeting from an economic or rotational point of view. Low levels of annual meadow-grass and many of the more prostrate/low-growing annual broad-leaved weeds, such as common field speedwell, fall into this category.

### Weed population changes

Changes in cultivation systems, routine use of specific herbicides over many years and climate change all lead to changes in weed populations.

The move to winter cropping established by minimum tillage has favoured weeds such as cleavers, black-grass and brome species, and led to decreased populations of spring germinating species such as hemp-nettles and charlock.

Changes in herbicide use and the widespread use of certain herbicide groups such as sulfonyl-ureas has led to shifts in susceptibility to these herbicides in several grass weeds, and in some broad-leaved species such as chickweed, scentless mayweed and fumitory. There is evidence of changes in fumitory populations, purple ramping and wall fumitory becoming more common.

A warmer climate may also be having an effect on the weeds, with grass weeds becoming more of a problem in spring crops, along with possible increases in weeds such as black-bindweed and higher numbers of weeds surviving the winters to set seed in spring crops.

## Weed Control

### Non-chemical weed control

Where non-chemical weed control is preferred, delaying sowing to allow some pre-sowing weed control (cultivating and killing weeds emerging in the seed-bed - stale seed bed technique) can help, although there is little time in the spring for this approach in most areas. Otherwise the use of harrows in the crop is the standard approach. There are various designs, and what suits the situation depends on soil type and stoniness, but semi-rigid tines are often preferred. In organic spring barley, passes at about the 3-4 leaf stage and at early-mid tillering should suffice. It is most effective when weeds are very small and some weeds with deep tap-roots, for example charlock, can be difficult to control unless they are taken very early. The best conditions for use of harrows are a drying soil, with no rain for two days after harrowing to prevent weeds re-rooting.

Where there are a lot of perennial weeds, sowing in wider rows and using inter-row hoeing may help, but this is less suitable for spring cereals than winter cereals.

### Integrated weed management

Integrated weed management uses non-chemical and other cultural and rotational approaches coupled with chemical control. On arable farms, spring barley has an increasing role in a whole-farm integrated strategy for dealing with problem weeds such as bromes and black-grass.

Bromes and black-grass are mainly autumn germinating, and tend to be less competitive in spring crops. Sowing a spring barley crop gives time for the stale seedbed technique to be used in the previous autumn in order to deplete the black-grass and brome seedbank in the soil. Following harvest, for black-grass and barren brome shallow cultivations are used to encourage germination then emerged weeds are sprayed off with glyphosate. With meadow, soft and rye brome there should be a delay of one month following harvest prior to the shallow cultivation. This is to prevent enforcing dormancy of seeds that are under-ripe at harvest time. Within the spring barley crop, herbicides can be chosen to help supress grass weeds. Any weeds that do grow can be rogued in order to prevent seed return.

Where ploughing is used, if soil conditions allow, there are benefits to delaying ploughing to late winter. It benefits wildlife by allowing arthropods, slugs, birds and small mammals to graze weeds and weed seeds in the autumn and early winter. Delayed ploughing also has major environmental benefits in reducing nutrient leaching.

On arable/livestock farms spring barley can be used as a cleaning crop for many weeds, including perennial species such as thistles and also for annual meadow-grass. In grass swards annual meadow-grass is a common weed grass and can substantially reduce the productivity of the sward. Seeds tend to have low dormancy so seeds shed in previous spring barley crops may well germinate in the grass sward. This can be prevented to some extent by taking steps to control annual meadow-grass in spring barley crops prior to a field being sown to grass.

Integrated Crop Management (ICM) principles can be applied when using herbicides and cultural control can be integrated with the use of herbicides. Where herbicides are to be used, good weed control with lower doses below the full recommended dose can be achieved in vigorous crops grown in good seed-beds. Timing of treatment is critical – reduced doses are particularly effective where weeds are small.

Crop competition has a very significant role in weed control and there is evidence that crop variety has an impact on weed growth. Varieties that show good early ground cover help supress weeds and improve the chances of good weed control by herbicides and allow lower doses to be used. Good ground cover is achieved by using varieties with prostrate or planophile leaves early on. Varieties that form a dense canopy help to supress weeds later on. Additionally in situations where there is less reliance on chemical control seed rates can be increased to give a denser, more competitive crop. This approach can complement mechanical control using harrows in organic crops.

Account should be taken of the threat of herbicide resistance and integrating non-chemical approaches with chemical control should be part of the strategy to prevent the development of resistance. Using active ingredients with different modes of action within the crop, and across the rotation as a whole, helps combat the threat of resistance.

### Herbicide use

In many cases a single post-emergence treatment for broad-leaved weeds may be all that is required. Table 1 lists Authorised herbicides commonly used to target broad-leaved weeds in spring barley. Weed susceptibility data is taken from product labels and company web sites.

On livestock farms annual meadow-grass may be an issue. Whilst annual meadow-grass is not particularly competitive in spring barley it can seriously hamper harvest, particularly in wetter parts of the country. Additionally on livestock farms it may be desirable to control annual meadow-grass in order to prevent seed return to the soil. Residual herbicides for annual meadow-grass control are given in Table 2. They are most effective applied pre-emergence, but need soil moisture to work. Pendimathalin is particularly dependant on adequate soil moisture to be effective. In dry conditions early post-emergence application with a flufenacet or prosulfocarb-based product may be a better option - annual meadow-grass must be very small with only one or two leaves. If this early post-emergence option is used, it may be desirable to mix the residual with a foliar-acting broad-leaved weed herbicide to broaden the spectrum of broad-leaved weeds controlled.

For other grass weeds, a post-emergence spray with either pinoxaden or fenoxaprop-P-ethyl may be an option. Note that resistant populations of wild oats and black-grass are increasingly common in the UK to both fenoxaprop-P-ethyl and pinoxaden, although at the time of writing there are no confirmed cases of wild oat resistance in Scotland.

Pinoxaden gives good control of wild oats and ryegrass and has some effect on blackgrass. The pinoxaden product Axial must always be applied with Adigor adjuvant and can be applied from the crop 2 leaf stage to flag leaf sheath extending. Wild oats are controlled from the 2 leaf stage until the start of stem extension. Rye-grasses are controlled up to GS 39. Black-grass can be controlled up to GS 27 although earlier application is advised due to the likelihood of resistance. Tank-mixes are possible with some sulfonyl-urea herbicides and Axial (full dose) otherwise sulfonyl-urea and phenoxy herbicides must not be applied for 21 days before or 7 days after use of Axial. Check label for other mixtures.

Fenoxaprop-P-ethyl (Foxtrot) controls wild oats, black-grass and rough-stalked meadow-grass. It is applied between crop GS 12 and GS 30, no adjuvant should be used with fenoxaprop in spring barley. Wild oats are controlled from GS 12 to GS 39, rough-stalked meadow-grass is controlled from GS 12 to GS 30. If Foxtrot is applied in sequence with another spray chemical, an interval of 7 days must elapse between applications.

### Following crops

Where spring barley is to be followed by a broad-leaved crop, it is important to check for any following crop restrictions. These are summarised in Table 5. This is particularly important where minimum tillage is being used because some herbicides require ploughing before certain following crops. It is also important in fields that will be going into high value broad-leaved crops. Notable in this respect is diflufenican that can accumulate in soil if used in successive years. It may then risk damaging onions, leeks or other allium crops in particular.

### Undersown crops

The activity of herbicides that can be used on crops undersown with grass and clover is given in Table 3. A more extensive range can be used on grass alone. There are, however, very few products available, and no research has been funded to examine the competitiveness of weeds, improving weed control or reducing doses in these crops. As a consequence a number of weed species are not well controlled.

Before undersowing or before the clover emerges, bromoxynil can be used to control some broad-leaved weed seedlings emerged with the crop. It must be applied prior to emergence of clover - any emerging clover will also be killed.

**Table 3 Spring barley herbicides for crops undersown with grass and clover**

| Weed | 2,4-DB | tribenuron | 2,4-DB + MCPA | tribenuron + 2,4-DB |
|---|---|---|---|---|
| Black-bindweed | * | ** | ** | **** |
| Buttercup, creeping | **** | | **** | *** |
| Charlock | *** | **** | *** | **** |
| Chickweed, common | | **** | | **** |
| Cleavers | | | | * |
| Deadnettles | | *** | | *** |
| Dock, seedling | ** | | * | ** |
| Fat hen | **** | * | **** | **** |
| Forget-me-not | | ** | | |
| Fumitory, common | *** | *** | *** | *** |
| Hemp (day) nettle | ** | *** | | ** |
| Knotgrass | * | | *** | * |
| Marigold, corn | | | | |
| Mayweeds | | **** | | **** |
| Meadowgrass, annual | | | | |
| Nettle, small | *** | | *** | ** |
| Orache | | | | |
| Poppy | *** | *** | *** | *** |
| Redshank | *** | *** | *** | *** |
| Wild radish (runch) | *** | | *** | **** |
| Shepherd's purse | **** | *** | **** | **** |
| Speedwells | | | | |
| Spurrey, corn | | | | |
| Thistle, seedling | ** | ** | ** | ** |

NB Bromoxynil products (Table 1) can be used prior to undersowing, or before clover has emerged.

### Perennial weeds

Herbicides that give some control of perennial weeds are listed in Table 4. For many such weeds pre-harvest use of glyphosate is the best option provided they are still green and actively growing at that time.

**Table 4 Suggested treatments for perennial broad-leaved weeds in spring barley**

| Weed | Metsulfuron +/- thifensulfuron | MCPA | 2,4-D | Glyphosate pre-harvest | Mecoprop | Fluroxypyr | Clopyralid |
|---|---|---|---|---|---|---|---|
| Buttercup, creeping | * | * | ** | | | | |
| Colts-foot | | | | * | | | |
| Dock, seedling | ** | ** | ** | | * | * | |
| Dock, established | ** | | | ** | | | |
| Horsetail | | * | * | | * | | |
| Mint, corn | | | | ** | | | |
| Potato seedlings | ** | | | | | ** | * |
| Potato, volunteer groundkeeper | * | | | ** | | * | * |
| Sow-thistle, perennial | | * | * | ** | | | * |
| Thistle, creeping and spear | * | * | * | ** | | | ** |
| Couch-grasses | | | | ** | | | |

*good control, ** very good control

### Use of spray adjuvants

There is evidence that some herbicides, particularly sulfonyl ureas, are more active or more reliable with the addition of specific adjuvants, but take care to use the right ones or crop damage may occur. The grass weed herbicide pinoxaden has a label requirement for the adjuvant Adigor to be added. There is insufficient room in this note to add detailed information on adjuvants, but information is available through local consultants, distributors and on company web sites. It should not be assumed, however, that if an adjuvant works well with one herbicide, that it works well with others - and their use is at growers own risk unless the specific use is on the label. Some adjuvants can reduce the efficacy of certain herbicides

### Pre-harvest treatments

If herbicide sprays applied at normal timing fail to work, or if perennial weeds are a problem (see above), then glyphosate can be applied pre-harvest, once the grain has fallen below 30% moisture content. It is particularly effective in controlling couch grass - the recommended doses rate depends on the severity of the infestation (see product label). Additionally pre-harvest glyphosate acts as a harvest-aid at low doses to desiccate weeds that are at sufficient levels to interfere with crop harvesting. Crops grown for seed should not be treated with pre-harvest glyphosate – symptoms of glyphosate treatment are detectable in the germination test. Although crops destined for malt production may be treated with certain products, always check with your merchant before use. Glyphosate residues at very low levels and below the MRL are frequently detectable in cereal-based products. In order to minimise the risk of glyphose residues in grain, it is important not to routinely treat crops pre-harvest, use the minimum dose to control any weeds that are present, and not to apply it too early, or within 7 days of harvest.

### Resistance to herbicides

Weed resistance to herbicides is increasing. Black-grass resistance to most herbicides used for its control presents the greatest concern in the UK. Black-grass is a relatively recent arrival in Scotland, but the same pattern of metabolic resistance and genetically based target-site resistance is likely to occur. One of the best approaches is to mix or use in sequence, herbicides from different families of activity. But in spring barley that is not easy as the main herbicides used are in the same family. Using tri-allate then pinoxaden or fenoxaprop-P-ethyl may help. However, use herbicides from other families in other parts of the rotation wherever possible. Also use husbandry techniques such routine or rotational ploughing and control in fallow breaks with glyphosate wherever possible. There is some local wild-oat resistance in parts of the UK, but it is not confirmed in Scotland. Chickweed and poppy resistance to sulfonyl-urea herbicides has been found in UK crops, with chickweed in Scotland in particular. Again use mixtures of herbicides from different families (see Table 1) with chickweed activity whenever possible, for instance mixing a sulfonyl urea with fluroxypyr. Resistance to these herbicides in scentless mayweed has been confirmed in Scotland and in other weed species is likely to develop over time.

For detailed information on herbicide resistance see the Weed Resistance Action Group's Guidelines on the AHDB website https://cereals.ahdb.org.uk/wrag

### Careful use of herbicides

Take great care when using any herbicide to prevent drift onto neighbouring property, crops and other surrounding vegetation. In particular, many broad-leaved weed herbicides used in cereals are highly active on broad-leaved crops, and may cause serious damage if conditions are conductive to spray drift.

Take great care to avoid drift when using clopyralid and sulfonyl-urea based herbicides, and particularly glyphosate next to seed potato crops. In fact all herbicides should be used very circumspectly next to seed potato crops.

Make sure the spray-tank, lines, boom and nozzles are cleaned out thoroughly at the end of spray operations and at the end of the day. Follow herbicide manufacturers' instructions as to appropriate measures for cleaning spray equipment. This is particularly important for sulfonyl-urea herbicides.

Avoid the use of complex non-recommended tank mixes. Not only can they damage the crop, they may also lead to chemical reactions in the spray-tank which may cause deposition of chemicals in the spray equipment, and affect safety to the operator, environment and following crop to be sprayed. Information on tank mixes for herbicide products can be found on company web sites.

**Precautions**

***USE HERBICIDES SAFELY. READ THE LABEL.*** Only use products authorised for use in a manner prescribed by an authorised label or by an Off-label Extension of Authorisation for Minor Use (EAMU). Follow the Code of Practice for using Plant Protection Products and take account of any additional regulations resulting from the EU Sustainable Use Directive.

Note that a 5 m no-spray buffer zone is required where certain pesticides are used near surface water (LERAP status). This can also include dry ditches and open drains. Details are on product labels. For some products, a wider Drift Reducing Technology (DRT) buffer zone is required.

Whilst every endeavour is made to be accurate and up to date, no responsibility is taken for the accuracy of the details in this Technical Note. Always check the herbicide product label before spraying.

Some data presented in this Technical Note has been largely derived from historic trials funded by SEERAD and the AHDB.

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**Table 1 Activity of herbicide products and mixtures for spring barley on common broad-leaved weeds**

| Weeds | Amsinckia/bugloss | Black-bindweed | Charlock | Chickweed, common | Cleavers | Crane's-bill | Deadnettles | Fat hen | Forget-me-not | Fumitory, common | Groundsel | Hemp-(day)-nettle | Knotgrass | Marigold, corn | Mayweeds | Nettle, small | Nipplewort | Orache | Pansy, field | Poppy, common | Radish, wild runch | Redshank, pale persiceria | Shepherd's purse | Speedwells | Spurrey, corn | Volunteer oilseed rape |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ALS inhibitors: Includes sulphonyl-ureas (HRAC Group B)** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Amidosulfuron | - | - | S | - | S | | - | - | S | - | - | - | - | - | - | - | - | - | - | - | S | - | S | - | - | S |
| Amidosulfuron + iodosulfuron | - | S* | S | S | S | | - | - | M | - | - | - | M* | - | S | - | - | - | - | M | S | - | S | M | - | S |
| Florasulam | - | - | S | S | S | | - | - | - | - | - | - | - | - | S | - | - | - | - | - | S | - | S | - | - | S |
| Metsulfuron | S | M* | S | S | - | | S | S* | M | - | - | S | S* | S* | S | S | - | M* | S* | S | S | S | S | S* | S* | S |
| Metsulfuron+ / tribenuron | S | M | S | S | - | | S | S* | M | M* | - | S | S* | S* | S | S | - | M* | M* | S | S | S | S | S* | S* | S |
| Thifensulfuron / metsulfuron+ | S | S | S | S | S | | S | M* | S | | - | S | S* | S | S | S | S | S | S* | S | S | S | S | M | S | S |
| Thifensulfuron / tribenuron | - | - | S | S | - | | - | S | - | - | - | - | S | S* | S | S | - | S | S* | S | - | S | S | M | - | S |
| Tribenuron | - | S* | S | S | - | S* | S* | S* | S* | S | S* | S* | S* | - | S | S | - | S | M* | S | S | S | S | M | - | S |
| **Synthetic auxins (Hormonal-types) (HRAC Group O)** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2, 4-D | - | M | S | - | - | | - | S | M | M | - | M | M | - | - | S* | - | M | - | M | S* | M | S | - | - | S |
| Dicamba + MCPA + mecoprop-P | - | S | S | S | S* | M | - | S | - | M | M | M | S | - | S* | S | S | S | - | S* | S | S | S | - | S | S |
| Dicamba + mecoprop-P | - | S | S | S | S* | | - | S | M | S | S* | M | S | - | S** | S | - | S* | - | M | S | S | S | M | M | S |
| Fluroxypyr | - | S | - | S | S | | S* | - | S | M* | - | S | M* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| MCPA | - | - | S | - | - | | - | S | M | M | - | S* | - | - | - | M | - | S* | - | S* | S | - | S | - | - | S |
| Mecoprop-P | - | M | S | S | S | M | M* | S | M | M | - | - | - | - | M | S | - | S* | - | M | S | - | S | M | - | S |
| Dichlorprop-P + MCPA + mecoprop | | | S | S | S | S* | M* | S | | M | | S | | | M | | | | M* | S | M | M | S | M | S | M |
| Clopyralid | | M | | | | | | | | | S* | | | S* | S | | | | | | | M* | | | | |
| Halauxifen + fluroxypyr | | S | | S | S | S | S | S | S | S | M | S | M | | | S | | M | S | S | | S* | S | M | M | |
| **Contact herbicides (HRAC Group C3)** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bromoxynill | | S | S | M | M | M | M | S | | M | S* | M | S | | S* | | | | M | S | | M | S | M | | S |
| **Mixtures of herbicides in different groups** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Carfentrazone + mecoprop-P | - | - | S | S | S | | S | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | S | - | - | - |
| Fluroxypyr + florasulam | - | - | - | S | S | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Clopyralid + florasulam + fluroxypyr | | S | S | S | S | | S* | S* | M | S* | S* | S | S | S | S | | | | | M | S | | S | | M | S |
| Halauxifen + florasulam | | S | S | S | S | S | S | S | M | S | M | M | | | S | M | | M | | S | S | M | S | M | | S |

S Susceptible; M Moderately susceptible
*Seedlings (up to 2-4 leaves)

Common names of herbicides given- see Table 6 for product examples.

Common herbicide names may be shortened, e.g. metsulfuron = metsulfuron-methyl; again see Table 6 for full name.

** control differs between species

**Table 2 Activity of residual herbicides targeting grass weeds**

| Weeds | Annual meadow-grass | | Black-grass | | Barren brome | | Ryegrass | | Wild oat | | Black-bindweed | | Charlock | | Chickweed, common | | Cleavers | | Deadnettles | | Fat hen | | Forget-me-not | | Fumitory, common | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pre/Post emergence** | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Chlorotoluron + diflufenican + pendimathalin | S | S[2] | | | | | | | | | | | S | S[2] | S | S[2] | S | S[2] | S | S[2] | | | S | S[2] | S | S[2] |
| Diflufenican | | | | | | | | | | | | | S | | S | S | | | S | S | | | | | S | |
| Flufenacet + diflufenican | S | S[2] | | | | | | | | | | | | | S | S | | | S | | | | M | | | |
| Pendimethalin | S | | | | | | | | | | | | | | S | | | | S | | S | | S | | M | |
| Flufenacet + pendimethalin | S | S[2] | | | | | | | | | | | | | | | | | | | | | | | | |
| Picolinofen + pendimethalin | S | S[2] | | | | | | | | | | | M | S | S | S | | M | S | S | M | | | | | S |
| Prosulfocarb | S | S[3] | | | | | | | | | | | | | | | | | | | | | | | | |
| Tri-allate | S* | | S* | | S* | | | | S | | | | | | | | | | | | | | | | | |

| Weeds | Hemp-(day)-nettle | | Knotgrass | | Mayweeds | | Nettle, small | | Pansy, field | | Poppy, common | | Radish, wild runch | | Redshanks, pale persiceria | | Shepherd's purse | | Deadnettles | | Speedwells | | Spurrey, corn | | Volunteer oilseed rape | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pre/Post emergence** | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Chlorotoluron + diflufenican + pendimathalin | | | | | S | S[2] | | | S | S[2] | S | S[2] | S | S[2] | | | S | S[2] | S | S[2] | | | S | S[2] | | |
| Diflufenican | | | | | | | | | S | | S | | | | | | S | S | S | S** | S | | S | S | | |
| Flufenacet + diflufenican | | | | | M | | | | S | S | | | | | | | | | S** | S** | | | | | | |
| Pendimethalin | S | | S | | | | S | | S | | S | | | | | | M | | S | | | | M | | | |
| Flufenacet + pendimethalin | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Picolinofen + pendimethalin | S | | M | | | | | | | | M | S | | | | | | S | S | S | | | S | M | | |
| Prosulfocarb | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tri-allate | | | | | | | | | | | | | | | | | | | | | | | | | | |

* moderate populations as part of integrated control strategy

1 - up to 1 leaf 2 - up to 2 leaves

**Table 5 Product information and following crop restrictions**

| Active ingredients | Products | Manufacturers | Crop growth stages (incl.) | Following crop restrictions following normal harvest. Always check the label. |
|---|---|---|---|---|
| **ALS inhibitors** | | | | |
| Amidosulfuron | Eagle | Interfarm | GS 12 - 49 | Only winter oilseed rape, mustard, turnips, winter field beans or vetches may be sown in the same year as treatment and these must be preceeded by ploughing or thorough cultivation |
| Amidosulfuron + iodosulfuron-methyl | Chekker, Sekator OD | Bayer & Interfarm | GS 13 - 39 | Cereals, winter oilseed rape and winter field beans may be sown in the same year as treatment provided they are preceeded by ploughing or thorough cultivation. Any crop may be sown in the spring of the year following treatment. A minimum of 3 months must elapse between treatment and sowing winter oilseed rape. |
| Florasulam | e.g. Lector | Headland and others | | Restricted crops including cereals and oilseed rape in year of treatment. Check the label for crops that can be sown in the year following treatment. |
| Metsulfuron-methyl | e.g. Jubilee SX, Pike, Savvy | Du Pont, Nufarm, Rotam and others | GS 12 - 39 | In year of treatment, cereals, oilseed rape, field beans, grass may be sown. No ploughing requirement. Other restrictions apply to tank mixes. |
| Metsulfuron-methyl + tribenuron-methyl | e.g. Ally Max, Boudha | Du Pont, Rotam and others | GS 13 - 39 | In year of treatment, cereals, oilseed rape, field beans, grass. No ploughing requirement. |
| Thifensulfuron-methyl+ metsulfuron-methyl | e.g. Harmony M SX, Choir, Ergon, Pennant | Du Pont, Nufarm, Rotam, Headland | GS 13 - 39 | In year of treatment, cereals, oilseed rape, field beans, grass. No ploughing requirement. |
| Thifensulfuron-methyl+ tribenuron-methyl | e.g. Concert SX, Calibre SX | Du Pont, Certis and others | GS 13 - 39 | In year of treatment, cereals, oilseed rape, field beans, grass. No ploughing requirement. |
| Tribenuron-methyl | e.g. Triad, Thor, Quantum SX | Headland, Nufarm, Du Pont | GS 13 - 39 | In year of treatment, cereals, oilseed rape, field beans, grass. No ploughing requirement. |
| **Synthetic auxins (Hormonal-types)** | | | | |
| 2, 4-D | Various | Various | GS 15 - 30 (not to malting barley) | No restrictions |
| Dicamba + MCPA + mecoprop-P | Mercam Plus, Hyprone P | Nufarm, Agrichem | GS 15-31 | No restrictions |

**Table 5 (Continued) Product information and following crop restrictions**

| Active ingredients | Products | Manufacturers | Crop growth stages (incl.) | Following crop restrictions following normal harvest. Always check the label. |
|---|---|---|---|---|
| Fluroxypyr | e.g. Starane 2, Crescent, Barclay Hudson | Dow, Certis, Agriguard, Barclay and others | GS 12 - 39 | Clover, peas, beans and other legumes must not be sown for 12 months following treatment at the highest dose |
| MCPA | e.g. Agritox, Headland Spear, Agrichem MCPA | Nufarm, Headland, UPL and others | GS 15 - 30 | No restrictions |
| Mecoprop-P | e.g. Duplosan KV, Optica | Nufarm, Headland and others | GS 11 - 30 | No restrictions |
| Dichlorprop-P + MCPA + mecoprop | Optica Trio, Isomec Ultra, Hymec Triple | Headland, Nufarm, Agrichem | GS 11 - 31 | No restrictions |
| Clopyralid | e.g. Dow Shield 400 | Dow and others | GS 12 - 32 | Straw left in field, or in manure or digestate may contain residues that can damage certain crops - do not sow winter beans following treated spring barley if straw is not removed from field |
| Halauxifen-methyl + fluroxypyr | Pixxaro, Whorl | Dow | GS 13 - 45 | Restricted crops including wheat, barley and oilseed rape in year of treatment, ploughing required before certain crops |
| Contact herbicides (HRAC Group C3) | | | | |
| Bromoxynill | Maya, Flagon 400 EC, Akocynil 225 EC, Buctril | Nufarm, Makhteshim, Aako, Bayer | GS 12 - 31 | No restrictions |
| **Mixtures of herbicides in different groupss** | | | | |
| Carfentrazone + mecoprop-P | Platform S | Belchim, Headland | GS 12 - 33 | No restrictions on succeeding crops 3 months after application |
| Fluroxypyr + florasulam | Spitfire, Cleave | Dow, Adama | | Cereals, oilseed rape, field beans or grass may follow treated crops in the same year. Oilseed rape may suffer temporary vigour reduction after a dry summer. Check label for crops that maybe sown in year following treatment. |
| Clopyralid + florasulam + fluroxypyr | Galaxy | Dow | GS 13 - 32 | Straw left in field, or in manure or digestate may contain residues that can damage certain crops - particularly legume crops, carrots and parsnips and potatoes. |
| Halauxifen + florasulam | Zypar | Dow | GS 13 - 45 | Plough before sensitive species such as clover |

**Table 5 (Continued) Product information and following crop restrictions**

| Active ingredients | Products | Manufacturers | Crop growth stages (incl.) | Following crop restrictions following normal harvest. Always check the label. |
|---|---|---|---|---|
| **Residuals** | | | | |
| Chlorotoluron + diflufenican + pendimathalin | Tower | Adama | Before GS 30 | No restrictions following a normal harvest |
| Diflufenican | Various | Various | Pre-em - GS 31 (at lower dose rate) | Certain broad-leaved crops at risk particularly if diflufenican is used in successive seasons. Check the label for details, and for the requirement to plough. |
| Flufenacet + diflufenican | Liberator (EAMU) | Bayer | Pre-em - GS 23 | Ploughing or cultivation to 15 cm required before certain broad-leaved crops. If Liberator or other products containing diflufenican are used in successive seasons, diflufenican can accumulate in the soil and be a risk to certain following broad-leaved crops |
| Pendimethalin | Various | Various | Pre-em | Ploughing or cultivation to 15 cm required before crops other than cereals |
| Flufenacet + pendimethalin | Crystal (EAMU) | BASF | Pre-em - GS 22 | Ploughing required to 15 cm before all following crops except potatoes, peas, wheat and barley |
| Picolinofen + pendimethalin | Chronicle, Galivor, Orient, PicoPro, Sienna | BASF | Pre-em | Before ryegrasss land must be ploughed or cultivated to 15 cm |
| Prosulfocarb | Defy, Fidox, Jade (EAMU) | Syngenta | Pre-em to 13 | Beans should not be sown for 12 months |
| Tri-allate | Avadex Excel 15 G, Avadex Factor | Gowan | Pre-drilling incorporated or pre-emergence | Oat or grass crps should not be sown for 12 months |
| **ACCase inhibitors** | | | | |
| Fenoxaprop-P-ethyl | Foxtrot, Oskar | Headland | GS 12 - 30 | No restrictions |
| Pinoxaden | e.g. Axial | Syngenta and others | GS 12 - 36 | No restrictions |