Technical Note

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SAC

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Spring barley weed control

Spring barley responds positively to weed control in terms of yield, ease of harvest, grain quality and reduced weed seed contamination. This Note examines how weed populations have changed, shows how to select your weed control programme to optimise herbicide use, potentially reducing use and minimising environmental impact and costs, and reviews the treatments currently available. The experimental evidence used is largely based on funding from SEERAD and the Home-Grown Cereals Authority (HGCA).

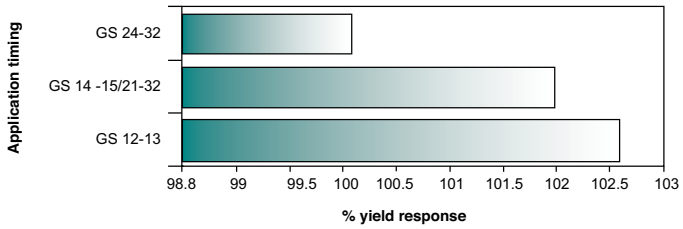
SUMMARY

- **Do not expect large yield benefits from weed control in spring, but weed control is still needed for harvest benefits, grain quality and rotational benefits**
- **The range of weed species common in spring barley has changed**
- **Use integrated weed management techniques to improve weed control and reduce environmental impact**
- **Herbicides should be used carefully. Reductions in doses are possible given the right conditions**
- **Conditions which encourage crop and weed growth also encourage herbicide activity, but keep doses up in very weedy fields**
- **The range of herbicide treatments is reviewed**

Cost Benefits of weed control

There is evidence from SAC trials that yield benefits are relatively small in spring barley in arable rotations (Figure 1). However, if weed populations are very high, as is often the case in traditional arable/stock rotations, then good yield responses are likely. Weed control is not advised in the basis of yield response alone. Leaving weeds uncontrolled will increase the weed seed burden in the soil and effect other crops in the rotation. This may be a particular problem in vegetable, fruit crops and other minor crops where the range of available treatments is reducing rapidly.

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



The presence of weeds at harvest (Table 1) will effect the efficiency of combining, and matter other than grain (MOG) in the grain sample. The cost of cleaning grain for weed seeds and chaff can be quite high and some weed seeds are not readily cleaned out.

Weed growth right up to harvest tends to maintain high moisture levels in the straw and grain, delaying harvest, or necessitating the use of a pre-harvest desiccant to assist combining.

The impact of such delays and grain contamination may effect the marketability of the grain; particularly where higher quality is demanded for malting crops and seed crops.

Nevertheless, the current reduced value of barley grain, the demands of quality assurance, and the requirements of good environmental and

SAC receives support from the Scottish Executive Environment and Rural Affairs Department

health practice as laid down by Food and Environment Protection Act (FEPA), Control of Pesticides Regulations (1986) and related codes of practice means that the minimum amount of herbicide should be used consistent with efficient weed control.

The relative competitiveness of weeds

There has been little recent research on the relative competitiveness of weeds in spring barley to reduce yield, but work funded by the Department of Agriculture for Northern Ireland, observations in SAC trials, plus figures for winter wheat from workers at Long Ashton Research Station, indicate the following order of competitiveness for common weeds:

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 in this crop.

That is not to say that the less competitive weeds should not be targeted if there is a potential to harm the crop in other ways, and the potential impact on other crops in the rotation where they are less easily controlled should be taken into consideration.

Nevertheless, there are often weeds present in spring barley at populations which do not justify targeting from a economic or rotational point of view, and can readily be controlled elsewhere in the rotation. Low levels of annual meadow-grass and many of the more prostrate/ low-growing annual broad-leaved weeds fall into this category.

Weed population changes

Changes in farming systems, routine use of specific herbicides over many years and changes in the climate can effect weed populations. The increase in winter cropping in the 1980s saw increases in weeds such as cleavers, speedwells, pansy, volunteer rape and grass weeds, which could also grow in the spring. Many common spring species decreased in populations, such as hemp-nettles and charlock in arable areas, also because of changes in herbicide use. Widespread use of certain herbicides such as sulfonyl-ureas and certain residuals, increased semi-resistant species to these herbicides, with the fumitory species a case in point. Recently fumitory species (purple ramping and wall) which have been considered relatively rare weeds have become 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

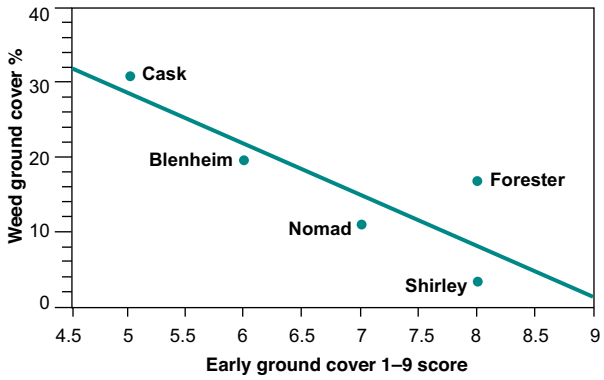
Where non-chemical weed control is preferred, delaying sowing to allow some pre-sowing weed control (cultivating and killing weeds emerging in the seed-bed - stale seed bed technique) can help, although there is little time in the spring for this approach in most areas. Otherwise the use of harrows in 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. 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

Where herbicides are to be used, good weed control with lower doses below the full recommended dose is best achieved in vigorous crops grown in good seed-beds. Crop competition has a very significant role in weed control. There is also evidence that crop variety has an impact on weed growth (Figure 2), and those varieties showing good early ground cover will improve weed control, and allow lower doses to be used. Good ground cover is achieved by using varieties with prostrate or planophile (+/- parallel with the ground) leaves early on and taller than average, sown at high plant populations.This approach may also reduce the number of mechanical passes required in organic crops.

Figure 2. Effect of earliness of crop ground cover on growth of weeds in spring barley varieties



Weed problems within the crop can be reduced by ploughing in the late winter to allow stubbles to be grazed in the autumn and early winter for weed seeds by arthropods, slugs and birds, This has also major environmental benefits in reducing nutrient leaching.

Spring barley itself is useful crop in the rotation, breaking the build-up of populations of many winter crop weeds, and can be used as a cleaning crop for many weeds, including perennial species such as thistles.

Use of herbicides

Table 2 lists common broad-leaved weeds found in spring barley, and Approved herbicide products which are widely available for use in this crop. The list of herbicides has been split into the main constituents of herbicide programmes by chemical family. It also indicates potential herbicide mixtures as generally more than one active ingredient is

Pre-emergence herbicides

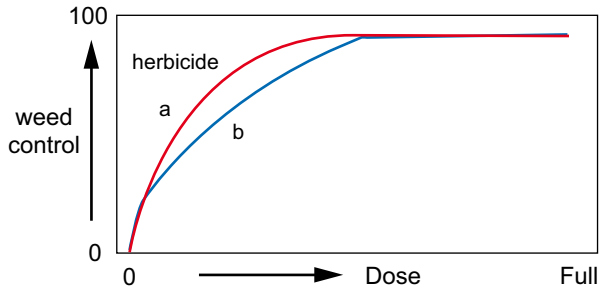
Table 2 does not list the few pre-emergence (crop and weeds) herbicides Approved for use: pendimethalin and linuron. They are not widely used because of the potential for the ground to dry out rapidly in the spring, reducing their effectiveness. Pre-emergence herbicides should only be used on early sown crops when there is plenty of moisture available. The broadest spectrum and most commonly used is pendimethalin, and it is usually used where annual meadow-grass is potentially a serious problem.

needed to get broad-spectrum weed control. See boxes for wild-oat and other grass weed control.

Dose reduction

Table 2 gives the expected susceptibility of weeds to the herbicides at label recommended doses. Work at SAC and DANI, and particularly in Denmark, has clearly shown that *reductions in dose are possible given good conditions, good crop vigour, moderate weed densities, and application at the right growth stages*. Many of the listed herbicides have been tested with SEERAD and HGCA funding to examine their relative dose response curves (Figure 3). Each herbicide is tested at a range of doses over a range of weeds, and the rate at which activity drops as dose drops is used as an indicator of how robust a treatment is to dose reduction, and also to adverse conditions.

Figure 3. The dose response curve



Given good growing conditions and crop vigour, most herbicide treatments can be reduced, and there is some evidence (Table 3) from SAC and DANI trials that given such conditions, doses should be reduced or some loss in crop yield may occur. The information available on dose curves is far from comprehensive in the UK compared with the heavily state-funded programme in Denmark, but the Scottish results tend to confirm those from Denmark.

Ideal conditions for herbicide activity vary between chemicals, but in general, *conditions which encourage crop and weed growth also encourage herbicide activity*. It is clear that in poorer conditions some herbicides are more effective than others; for example bromoxynil + ioxynil is a better additive than mecoprop-p to major constituent herbicides in dry conditions, whereas mecoprop-p is more effective in moist/mild conditions.

Impact of weed density

Experimental evidence shows a scatter of yield responses to overall weed populations in spring barley (Figure 4). However, high weed populations can effect the dose response curve adversely (Figure 5). *Keep doses up in very weedy fields*.

Figure 4. Mean yield responses in 19 trials to herbicide use in spring barley, related to weed growth cover in July

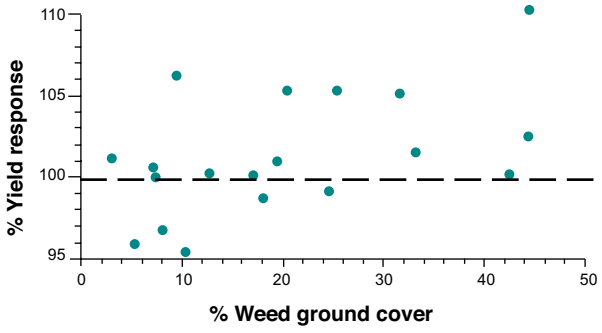
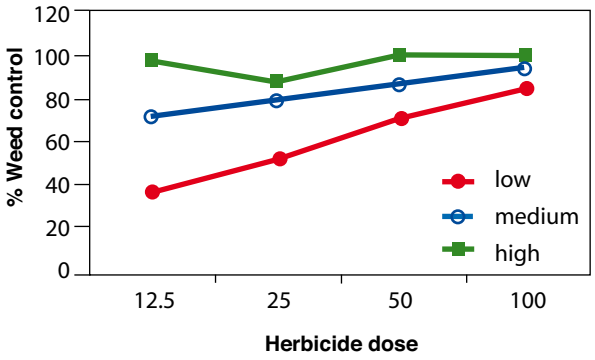


Figure 5. Impact of weed levels on the dose response curve of a herbicide in spring barley 1991



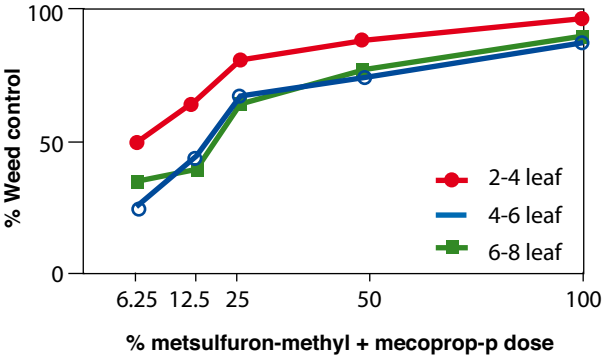
Impact of crop vigour

Varietal differences can effect crop vigour, but within a variety, variation in vigour can have a marked effect. A crop deficient in a nutrient will be less competitive than a crop with no deficiencies. Herbicide dose reduction is far more possible in vigorous crops.

Impact of timing of treatment

The impact of timing of a herbicide on weed control and the dose response curve is shown in Figure 6, derived as a mean of six trials. In general, smaller weeds are better controlled, and so aim to get broad-leaved weeds before they reach the 6 leaf stage, and preferably at the 2-4 leaf stage. Figure 1 also shows the yield benefit, although small, from early use of herbicides.

Figure 6. Effect of timing on a herbicide dose response curve (mean of 6 trials)



Resistance to herbicides

Undersown crops

The activity of herbicides that can be used on crops undersown with grass and clover is given in Table 4. 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 + ioxynil can be used to control broad-leaved weed seedlings emerging with the crop. However, any emerging clover will also be killed.

Perennial weeds

Herbicides that give some control of perennial weeds are listed in Table 5. For many such weeds pre-harvest use of glyphosate is the best option if they are still green and growing at that time.

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 below 30% moisture content. It acts as a harvest-aid at low-doses to desiccate weeds that are at sufficient levels to interfere with crop harvesting, and at higher doses to give long-term control of perennial weeds (see above). *Crops destined for seed should not be treated with glyphosate. Such treatment can seriously affect the growth and vigour of seedlings and SASA have noted a significant number of samples tested for germination show glyphosate symptoms.* Although crops destined for malt production may be treated with certain products, it is best to check with your merchant before use.

Glufosinate-ammonium (Challenge/Harvest) can also be used as a harvest-aid in laid/weedy crops of spring barley, but not seed crops, when grain moisture is below 30%, at least 14 days before harvest.

Diquat (Reglone) can also be used as a desiccant of weeds in an emergency in laid crops, 4-7 days before harvest. The crop can only then be used for stock feed.

Use of spray adjuvants

There is evidence that some herbicides are more active, or more reliable, with the addition of specific adjuvants, in particular sulfonyl-ureas (such as tallow-amine polymer based adjuvants- but take care to use the right ones- crop damage may occur. Grass weed herbides tralkoydim and pinoxaden must have an adjuvant added to work. Also some adjuvants can reduce the efficacy of certain herbicides. There is insufficient room in this note to add detailed notes on adjuvants, but information is available through local advisors, and distributors. 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 your own risk unless the specific use is on the label.

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, but 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.

Precautions

USE HERBICIDES SAFELY. READ THE LABEL. Only use products approved for use under the Food and Environment Protection Act (FEPA), Control of Pesticides Regulations (1986) in a manner prescribed by an approved label or by an Off-label Notice of Approval. Follow the Code of Practice under the Control of Substances Hazardous to Health Regulations, 1988 (COSHH). SEERAD has produced a new 'Code of Practice for Using Plant Protection Products in Scotland' in 2007, published by HSE and the Scottish Executive.

Note that a 6 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. Further changes may be made to these limitations in the near future. At present a 6 m buffer zone is required for nominated herbicide products.

Whilst every endeavour is made to accurate and up to date, no responsibility is taken for the accuracy of the details in this Technical

Note.

The data presented in this Technical note has been largely derived from trials funded by SEERAD and the HGCA.

An example of the decision process for broad-leaved weed control

What weeds are present?

Select appropriate herbicide treatment.

Which are the most important weeds to control?

Reselect treatments on this basis to favour those most active on those species.

What is the crop's growth stage?

Discard treatments that are not appropriate.

What growth stages are the weeds?

Reduce doses for smaller weeds, increase for larger weeds.

Has it been cool and dry or very warm and dry over the past two weeks?

Add herbicides more effective in dry conditions, eg bromoxynil/ioxynil. Maintain higher doses.

Has it been mild and moist over the past two weeks (good growing conditions)?

Most herbicides are very effective in such conditions, consider reducing doses.

Is the crop vigorous and with good ground cover?

Consider reducing doses; keep doses higher in thin crops, or in varieties which have an upright habit.

Is the overall weed population very high or low?

Keep herbicide doses up if the population is high, but reduce doses if it is low.

Herbicides for Wild-oat Control

The herbicides below can be used for wild-oat control in spring barley. Note carefully their timing of treatment in relation to use of herbicides for broad-leaved weed control. Failure to comply may mean a failure in weed control.

Herbicide (and Mode of Action)	Product(s)	Max Dose	Wild-oat timing	Crop timing	Timing with other herbicides
tri-allate (Inhibits lipid synthesis)	**Avadex Excel 15G**	15kg/ha granule	*Pre-emergence*	*Pre-emergence*	No limitation
diclofop-methyl + fenoxaprop-p-ethyl (ACCase inhibitor)	**Tigress Ultra**	1.5-2l/ha	*GS12 to before GS31*	*Before GS32*	Do not use hormone herbicide within 7 days. Check label for mixtures.
tralkoxydim (ACCase inhibitor)	**Alpha Tralkoxydim, Landgold Tralkoydim, Strimma, etc**	1.0l/ha + Output or other suitable adjuvant	*GS12 to GS31*	*GS30 to GS39*	Sulfonyl-urea and penoxy hormone herbicides must not be applied within 14 days before or 7 days ater use of tralkoxydim. Extend to 20 and 10 days in drought conditions. Check label for other mixtures.
pinoxaden (ACCase inhibitor)	**Axial**	0.2-0.3l/ ha + Adigor adjuvant	*GS11- GS39*	*GS12-GS39*	Tank-mixes are possible with some sulfonyl-urea herbicides and Axial (full dose) otherwise sulfonyl-urea and phenoxy herbicides must not be applied within 21 days before or 7 days after use of Axial. Check label for other mixtures.

Grass weeds other than wild-oats

The commonest grass weed in spring barley is annual meadow-grass. Pendimethalin pre-emergence can be used, but can fail in dry soils. There is an off-label approval for the use of certain isoproturon products early post-emergence, and iodosulfuron can also be used, which gives useful meadow-grass suppression. Rough meadow-grass is less common in spring crops, and some suppression is possible with pendimethalin and isoproturon. However, good control is possible with pinoxaden and tralkoxydim wild-oat treatments.

Rye-grass from seed is best controlled with pinoxaden (Axial at 0.3-0.45l/ha with adjuvant) or tralkoxydim (eg Strimma at 1.0l/ha with adjuvant) or diclofop-methyl + fenoxaprop-p-ethyl (Tigress Ultra at 1.5-2.0l/ha): see Wild-oat control table. There is some resistance known to the latter two treatments.

Black-grass has appeared in the last few years,and pinoxaden (Axial at 0.45-0.6l/ha with adjuvant) may be the best treatment at present. Tralkoxydim and diclofop-methyl + fenoxaprop-p-ethyl have some effect on black-grass, but resistance is common in English populations. Tri-allate granules (Avadex Excel 15G) has helpful activity pre-emergence, and isoproturon can help post-emergence.

Soft brome has been found more often in spring barley in recent years. Unfortunately good control is not possible, although isoproturon may check seedlings, as may tri-allate granules pre-emergence (see Wild-oat control table). Use fallow/ set-aside breaks to reduce the populations of this weed, plus graminicides in broad-leaved crops, along with deep ploughing in rotation.

Common couch-grass and other perennial grasses should be treated pre-harvest with a good glyphosate product at 2-4l/ha if possible. Shoots should still be green and fresh.If that is not possible, treat in fallow breaks or in crops that harvest earlier.

Resistance to herbicides

Herbicide 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 tralkoydim 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 samples tested for SAC have not shown any resistance in Scottish populations.

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 familes (see Table 2) with chickweed activity whenever possible, and if that is not possible, use in sequence. Resistance to these herbicides may slowly move into other species in time.

For detailed information on herbicide resistance and its management get a copy of the Weed Resistance Action Group's Guidelines: 'Managing and preventing herbicide resisatnce in weeds' published by HGCA, Caledonian House, 223 Pentonville Road, London N1 9HY, publications@hgca.com, or an on-line pdf version at http://www.pesticides.gov.uk

Table 1: Effect of presence of knot-grass at harvest on spring barley matter other than grain yield (MOG), and losses from straw walkers; SAC trial

	% ground cover of knot-grass at harvest	MOG yield t/ha	% yield loss from straw walkers
Mean of herbicide treatments	0	7.0	1.6
Untreated	40	9.9	3.0

Table 3: Impact of herbicide dose (mean of all relevant treatment doses) on mean grain yield in 14 spring barley trials

% of recommended herbicide dose applied	Grain yield t/ha @ 85%DM
12.5	6.20
25.0	6.22
50.0	6.22
100.0	6.13
Untreated	6.05
SED +/-	0.073

Table 2: Activity of candidate herbicide products and mixtures for spring barley on common weeds (2007)

Weeds	Amsinckia/bugloss	Black-bindweed	Charlock	Chickweed, common	Cleavers	Deadnettles	Fat hen	Forget-me-not	Fumitory, common	Fumitory, Purple/ wall	Hemp-(day)-nettle	Knotgrass	Marigold, corn	Mayweeds	Meadowgrass, annual	Nettle, small	Nipplewort	Orache	Pansy, field	Poppy, common	Radish, wild runch	Redshank, pale persiceria	Shepherd's purse	Speedwells	Spurrey, corn	Volunteer oilseed rape	Possibly useful mixes CHECK!!
ALS inhibitors: Includes sulphonyl-ureas (HRAC Group B)																											
1. Amidosulfuron	-	-	S	-	S	-	-	S	-	-	-	-	-	-	-	-	-	-	-	-	S	-	S	-	-	S	10-15,16,17,19,20,22
2. Amidosulfuron + iodosulfuron	-	S	S	S	S	-	-	S	-	-	-	M*	-	S	-	-	-	-	-	-	S	-	S	-	-	S	12-15,16,17,19
3. Florasulam	-	-	-	S	S	-	-	-	-	-	-	-	-	S	-	-	-	-	-	-	S	-	S	-	-	S	10-15,16,17,19,22
4. Iodosulfuron	-	S*	S*	S	-	S*	S*	-	-	-	S*	S*	-	S	(m)	-	-	-	-	-	-	-		S*	-	S*	15,16,19
5. Metsulfuron	S	M*	S	S	-	S	S*	M	-	-	S	S*	S*	S	-	S	-	M*	S*	S	S	S	S	S*	S*	S	1,10-15,16,17,18-20,22
6. Metsulfuron / tribenuron	S	M	S	S	-	S	S*	M	M*	-	S	S*	S*	S	-	S	-	M*	M*	S	S	S	S	S*	S*	S	10-15,16,17,18-20,22
7. 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	10-15,16,17,18,22
8. Thifensulfuron / tribenuron	-	-	S	S	-	-	S	-	-	-	-	S	S*	S	-	S	-	S	S*	S	-	S	S	M	-	S	10-15,16,17,18-20,22
9. Tribenuron	-	S*	S	S	-	S*	S*	S*	S*	-	S*	S*	-	S	-	S	-	S	S*	S	S	S	S	S*	-	S	1,10-15,16,17,18-20,22
Synthetic auxins / Hormonal-types (HRAC Group O)																											
10. 2, 4-D	-	M	S	-	-	-	S	-	M	-	M	M	-	-	-	S	-	M	-	M	S	M	S	-	-	S	5-9,11-15,16,17
11. Dicamba + MCPA + mecoprop-p	-	S	S	S	S	-	S	-	S	(m)	S	S	-	S	-	S	S	S	-	S	S	S	S	-	S	S	1,5-9,10,13,15,16,17
12. Dicamba + mecoprop	-	S	S	S	S	-	S	M	S	(m)	M	S	-	S	-	S	-	S*	-	M	S	S	S	-	M	S	1,5-9,10,13,15,16,17
13. Fluroxypyr	-	S	-	S	S	S*	-	S	M*	-	S	M*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1-9,11,15,16,17,19
14. MCPA	-	-	S	-	-	-	S	M	M	-	S	-	-	-	-	M	-	S*	-	S	S	-	S	-	-	-	1,2,5-9,10,11,14,16,17, 18,20,22
15. Mecoprop-p+	-	-	S	S	S	-	S	M	-	-	-	-	-	M	-	S	-	S*	-	M	S	-	S	-	-	-	1,2,5-9,10,11,14,16,17,18,20
Contact herbicides (HRAC Group C3)																											
16. Bromoxynil + ioxynil +	M	S	S	S	-	S	S	S	M	(m)	-	S	M	S	-	S	-	M	-	S	S	S	S	S	-	-	1-9,10-15,17,20
Urea (HRAC Group C2)																											
17. Isoproturon (Off-Label Approval)	-	-	S	S	-	-	S	-	-	-	-	-	S	S	S	S	-	-	-	S	-	-	S	-	S	-	1-3,5,6,8,9,13-15,16

Table 2: *continued*

Weeds	Amsinckia/bugloss	Black-bindweed	Charlock	Chickweed, common	Cleavers	Deadnettles	Fat hen	Forget-me-not	Fumitory, common	Fumitory, Purple/ wall	Hemp-(day)-nettle	Knotgrass	Marigold, corn	Mayweeds	Meadowgrass, annual	Nettle, small	Nipplewort	Orache	Pansy, field	Poppy, common	Radish, wild runch	Redshank, pale persiceria	Shepherd's purse	Speedwells	Spurrey, corn	Volunteer oilseed rape	Possibly useful mixes CHECK!!
Prepared Mixtures																											
18. Carfentrazone + mecoprop-p+	-	-	S	S	S	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-	-	5,7,9,19
19. Diflufenican+bromoxynil+ioxynil	-	MS	S	S	-	S	S	S	S	-	S	S	-	S	-	MS	-	-	S	S	-	S	S	S	S	-	1,3,5,7,9,12-14,15,20
20. Fluroxypyr + florasulam	-	-	-	S	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5-9,17,22
21. Fluroxypyr+ thifensulfuron+ tribenuron																											?
22. Mecoprop-p+ bromoxynil+ ioxynil+	S*	S	S	S	S	M*	S	S	S	(m)	S*	S*	-	-	-	-	-	M*	M*	S	S	S	S	S	-	S	1,2,5-9,10,14,16,17
23. Metsulfuron + cafentrazone	-	S	S	S	S	S	S	S	-	-	S	S	S	S	-	S	S	S	S	S	-	S	S	S	S	S	15

S Susceptible; M Moderately susceptible, (m) estimated effect- not on labels.

*Seedlings (up to 2-4 leaves) +tend to give general boost to weed control in mixtures labels before use- they vary

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.

Table 4: Spring barley herbicides for crops undersown with grass and clover

Weed	Acumen	Alistell	2,4-DB + MCPA	MCPB + MCPA	2,4-DB	MCPB
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						

Table 5: Suggested treatments for perennial broad-leaved weeds in spring barley

Weed	Metsulfuron +/- thifensulfuron	MCPA	2,4-D	Glypohosate pre-harvest	Mecoprop	Fluroxypyr
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

Table 6: Candidate herbicide products for use in spring barley (as in 2007)

Active ingredients	*Products*	*Manufacturers*	*Crop growth stages (incl.)*	*Notes*	*Relative price*
ALS inhibitors					*A=cheap*
1. Amidosulfuron	eg Eagle, Pursuit	Bayer	12-49	Broad-leaf weeds 6lf/flowerbud	B
2. Amidosulfuron+ iodosulfuron-methyl-sodium	Chekker	Bayer	12-30	Broad-leaf weeds 6lf/flowerbud	C
3. Florasulam	Boxer	Dow	13-39	Broad-leaf weeds 4lf/flowerbud	D
4. Iodosulfuron-methyl-sodium	Hussar	Bayer	13-29	Broad-leaf weeds 2lf/flowerbud plus AMG suppression.	D
5. Metsulfuron-methyl	various	various	13-38	Broad-leaf weeds 2lf/flowerbud	B
6. Metsulfuron-methyl+ tribenuron-methyl	Ally Max SX, BiPlay SX	Du Pont	13-38	Broad-leaf weeds 2lf/flowerbud	B
7. Thifensulfuron-methyl+ metsulfuron-methyl	eg Finish SX, Harmony M SX	Du Pont	13-38	Broad-leaf weeds 2lf/flowerbud	B
8. Thifensulfuron-methyl+ tribenuron-methyl	Calibre SX	Du Pont	13-38	Broad-leaf weeds 2lf/flowerbud	B
9. Tribenuron-methyl	Quantum SX	Du Pont	13-38	Broad-leaf weeds 2lf/flowerbud	B
Synthetic auxins					
10. 2,4-D	various	various	15-30	Broad-leaf weeds 2lf/flowerbud	A
11. Dicamba+ MCPA+ mecoprop-p	various	various	15-30	Broad-leaf weeds 2lf/flowerbud	B
12. Dicamba+ mecoprop-p	various	various	15-30	Broad-leaf weeds 2lf/flowerbud	B
13. Fluroxypyr	eg Tomahawk, Starane 2,	Makhteshim Agan, Dow	11-39	Broad-leaf weeds 2lf/flowerbud	C
14. MCPA	various	various	14/15-30	Broad-leaf weeds 2lf/flowerbud	A
15. Mecoprop-p	various	various	11-30	Broad-leaf weeds 2lf/flowerbud	B
Contact herbicides					
16. Bromoxynil+ ioxynil	Eg Alpha Briotril, Oxtril CM	Makhteshim Agan, Bayer	11-30	Broad-leaf weed seedlings	B
Ureas					
17. Isoproturon	Various- check label	various	11-30	Off-label approval (OLA) for some products for small broad-leaf weeds and AMG	B
Prepared Mixtures					
18. Carfentrazone+ mecoprop-p	Platform S	Belchim	21-32	Broad-leaf weeds 2lf/flowerbud	C
19. Diflufenican+ bromoxynil+ ioxynil	Capture	Bayer	13-31	Broad-leaf weeds 2-6lf; some residual activity	C
20. Fluroxypyr+ florasulam	eg Starane XL, Starane Gold,Hiker	Dow	13-39	Broad-leaf weeds 2lf/flowerbud	D
21. Fluroxypyr+ thifensufuron-methyl+ tribenuron-methyl	GEX353	Dow	13-38	Broad-leaf weeds 2lf/flowerbud	D
22. Mecoprop-p+ bromoxynil+ ioxynil	eg Swipe P	NuFarm	13-30	Broad-leaf weeds 2lf/flowerbud	B
23. Metsulfuron-methyl+ carfentrazone	Ally Express	DuPont	13-32	Broad-leaf weeds 2lf/flowerbud	D

Table 6 *continued*

ACCase inhibitors					
24. Diclofop-methyl+ fenoxaprop-p-ethyl	Tigress Ultra, Corniche	Bayer	10-31	Wild-oat, non-resistant black-grass GS12-39, RMG GS12-31	D
25. Pinoxaden	Axial + Adigor adjuvant	Syngenta	12-39	Wild-oat, black-grass, rye-grasses, onion couch, RMG, loose silky bent GS11-32.	D
26. Tralkoxydim	eg Alpha Tralkoxydim, Strimma, Landgold Tralkoxydim,etc	Makhteshim Agan, Landgold,etc	30-39	Wild-oat GS12-31, non-resistant black-grass 14-23, RMG, Yorkshire fog, awned canary-grass GS13-22.	D
Other Grass herbicides					
27. Isoproturon	Various- check OLA	various	11-30	AMG and RMG seedlings and some residual activity- see also 17 above.	B
28. Pendimethalin	Various- check label	various	Pre-emergence	AMG and some RMG control pre-emergence plus some broad-leaf weeds. Can also help black-grass control. Needs soil moisture.	B
29. Tri-allate	Avadex Excel 15G	Gowan	Pre-emergence	Wild-oats pre-em, plus help with black-grass, AMG and brome control. Needs soil moisture.	E

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