Crop specific guidance – IPM Weeds

The IPM Tool allows you to prioritise weeds that are important on your farm. This helps guide decisions on which IPM measures are appropriate. Implementing IPM can result in 'trade-offs' where methods to control one pest may increase another. Some of these trade-offs are included in the notes below and in the Tool. Prioritising weeds will help decide which are most important and where there are trade-offs. This guidance documents provides advice on IPM measures for weeds as part of the whole farm rotation, with specific advice provided on certain crops where appropriate.

Weeds IPM Measures

Not all weeds are highly competitive; some pose little threat to yield and may be valuable to wildlife. The level of damage caused depends on the weed species and the number present, the competitive ability of the crop and the growth stage at which the crop is susceptible to competition.

Weeds emerge at different times during the year and most problems occur when weeds and crops emerge at the same time. Integrated weed control is heavily reliant on encouraging weed germination at a different time to the crop:

- Earlier germination may allow weeds to be destroyed, by cultivation or a total herbicide, prior to the crop being planted.
- Later germination may allow the crop to outcompete the weed.
- Or germination may be at a time when mechanical cultivation within the crop is possible (e.g. by hoe).

Knowledge of when a weed will germinate can help to determine the appropriate control method. Moisture, temperature, light, day length and dormancy level can all affect the germination period.

Decision support including Apps

Decision support Apps are available to help identify weed species.

Source	Name	What it does	Location
Corteva	Forage app	Forage crops – weed identification and herbicide control solutions	https://www.corteva.co.uk/tools-and-advice/app-downloads.html
Corteva	Arable app	arable crops – weed identification and herbicide control solutions	https://www.corteva.co.uk/tools-and-advice/app-downloads.html
BASF	Weed ID app	Weed identification	https://www.agricentre.basf.co.uk/en/Services/Mobile-Tools/Weed-ID-app/
BASF	Xarvio field manager	Growing crops and identifying risks	https://www.agricentre.basf.co.uk/en/Services/xarvio-Digital-Farming-Solutions/
BASF	Xarvio scouting	Identify in field problems and stress factors	https://www.agricentre.basf.co.uk/en/Services/xarvio-Digital-Farming-Solutions/
Syngenta	Spray assist	Spray application assistance, mitigate	https://www.syngenta.co.uk/news/application/spray-assist-app-aid-application-target

		risks or alter practices	
Bayer	Fieldmate	Weed, pest, disease identification and product library	https://cropscience.bayer.co.uk/tools-and-services/agronomy-tool-app/

Links are provided to appropriate decision support tools in the IPM Tool.

Hygiene / prevention

Weed seeds are present in soil and can attach to machinery, vehicles and boots. Make sure to clean these between fields to prevent spread. Buy weed free seed and where home saved seed is used ensure that it is cleaned before sowing. Echinochloa (Barnyard grass) has become a problematic weed in maize as a contaminant in seed. Check seed being purchased for field margin, environmental areas and cover crops, as some samples can contain high levels of weed seeds particularly black-grass.

Check all straw bought onto the farm for use in animal bedding or strawing down carrots. This straw may contain weed seeds. Avoid the use of hay and silage contaminated with seed seeds for feeding, and if necessary, limit it to specific areas of the field or use a feeder. Silage contains fewer weed seeds if it has been preserved correctly. Weed seeds can also be spread onto fields through fresh manure. Compost manures so they reach a temperature of 60^{o}C to destroy weed seed, including docks. Heaps should be turned regularly. Remove weeds from around slurry lagoons or yards to prevent seeds entering the slurry.

Keep uncropped areas tidy as possible and mow regularly to prevent weeds flowering and setting seed, or sow competitive grasses. Remove weeds from wild areas of margins particularly those with seeds that are blown in the wind such as sow thistles. Do not overstock or overgraze fields to prevent poaching and the development of bare areas where weeds can establish.

Select low-risk locations

Fields with known problem weeds that are difficult to control in cereals should be avoided such as brome in barley, and couch or black-nightshade in potatoes. Consider another crop for the field where the problem weed can be tackled more easily.

Species / Varietal choice

Hybrid winter barley has been shown to reduce the productivity of blackgrass through competition. This is due to the increased height and broader leaves of the crop. Oats are generally more competitive but the number of herbicides for use in the crop is lower and grass weeds are more difficult to control.

Cover crops

Cover crops are sown before or after a crop to minimise the time the soil is left without green cover. Cover crops change the environment at the soil surface, generally discouraging weeds from emerging. The ideal cover crop is quick growing, so it competes with weeds and/or prevents their emergence, however information is limited on their effectiveness on weeds. Cover crops should be sown thinly so that weeds are encouraged to emerge, and then these can then be terminated with the cover crop.

Crop mixtures / companion planting

Companion cropping or intercropping is the growing of two or more crop species where part or all their crop cycle overlaps in time or location, and where one or more of the component species is taken to harvest. This can be used in part for weed suppression.

Fallow

Fallowing is taking land out of production for a whole season. The aim is to cultivate the soil regularly, encouraging weeds to germinate and killing them before any seed is set. A single year fallow can reduce black-grass numbers by 70%. A fallow is also effective for bromes and Italian ryegrass. Fallows should be managed so that no weeds set seed, and this can be achieved through multiple mowing or use of a total herbicide. Cultivation can stimulate a greater number of weeds to emerge.

Grass / Herbal Leys

Including a grass/ley in a rotation can prove effective in controlling blackgrass in problem fields. In grassland mob or intensive grazing or high stocking rates will force stock to graze weeds and allow grass to establish more successfully. Avoid poaching and compaction.

Improving soil conditions

Improving soil conditions including compaction, drainage, pH and nutrient status can help with weed control. Removing compaction improves establishment and makes the crop more competitive against weeds. To avoid compaction, do not graze vulnerable field when wet to prevent surface compaction.

Subsoil/Mole ploughing is used to improve drainage which can reduce weed problems such as rushes, docks and black grass. Improving drainage improves crop competivity and decreases the risk of weeds which prefer wet soils.

Rotation

In a rotation the choice of crop affects the type and timing of cultivations and time of drilling. A rotation allows a change in crop types and sowing dates which provide opportunities for different methods of weed control outside a cereal crop.

In spring crops there is selection for spring germinating weeds and likewise selection for autumn germinating weeds in autumn sown crops. Disrupting these crop/weed associations is a basic approach to actively discouraging the growth and reproduction of certain weed species.

Grass weeds are easier to control in broadleaved crops like oilseed rape and sugar beet. In oilseed rape propyzamide can be used to control blackgrass, and there is no known resistance to this herbicide.

Sowing Date

Changing the sowing date can have a significant effect on weed densities. A delay can be as small as a few weeks or changing from a winter crop to a spring one. Weeds have a main germination period, with brome and black-grass germinating predominantly in the early autumn and delaying drilling can miss the peak period. Weeds emerging before drilling can be sprayed off with glyphosate or soils cultivated. On any farm field drilling dates can be prioritised for drilling as to their weed burden, with

cleaner fields being drilled first. Seedrate may need to be increased to maintain crop competitivity in order to compensate for delayed drilling.

Spring sowing allows for fallow for part of the year (bastard fallow) can be useful and achieve similar effects to a full fallow. Incorporating a spring crop into a winter dominated rotation allows a bastard fallow.

Stale seedbed

A stale seedbed is defined as one prepared days, weeks, or months before establishing a crop. This technique is done to encourage a flush of weeds that are then killed by cultivation or non-selective chemical control, depleting the upper layers of the seed bank, and reducing subsequent weed emergence within the crop. Stale seedbeds are more beneficial if two flushes of emergence are achieved. When drilling minimize soil disturbance to prevent new weed seeds appearing from depth.

Increasing seed rate

A high seedrate will help to increase the competitivity of the crop suppressing annual broad-leaved weeds such as chickweed, speedwells, groundsel, mayweed, small nettle and others from establishing.

When establishing grass leys a high seedrate at drilling or when reseeding will help to prevent annual meadow grass germination and suppresses annual broad-leaved weeds such as chickweed, mayweed, small nettle and fat hen from establishing.

Stubble Management

Stubbles can be left uncultivated to allow birds and insects to eat weed seeds on the soil surface. Total herbicides such as glyphosate plus or minus 2,4-D (check label for following crop restrictions) can be used to remove all weed species.

Primary cultivations

Primary cultivation is the first cultivation that is conducted to prepare the soil for the next crop and can be classified into four groups: plough, deep and shallow till, and no-till. Changing the primary cultivation is an effective measure in changing weed populations.

Ploughing inverts the soil, burying 95% of freshly shed seed to 15-20cm at which they cannot germinate, but brings up 35% of old seed buried by previous cultivations however these are fewer in number than freshly shed seed due to the annual decline through seed death and predation. Ploughing also buries weeds that have already germinated.

Non-inversion tillage mixes the soil in the upper layers to the working depth of the implement. This can either be intensive, moving soil down to 30cm, or very minimal through the use shallow tillage. Shallow cultivations create a tilth suitable for crops to germinate and working depth may depend on the crop, but is typically around 10cm, to kill any germinating weeds. Varying the number and timing of this cultivation can be used as a technique for weed control. The weeds that germinate are a mixture of freshly shed seed and those from previous seasons. Approximately 50% of newly shed seed is buried below germination depth (5 cm) and 10% of old seed returns to the surface. Moving less soil means fewer weed seeds are exposed and do not germinate.

With no-till and direct drilling the only soil movement that occurs is that done by the drill and the freshly shed seed remains on the soil surface, and some weed seed falls down cracks in the soil. Freshly shed seed on the surface is subject to predation and death through desiccation or disease.

Precision application band spraying / weed wiper / spot spray

Precision application to weeds can reduce the amount of herbicide used. The use of video cameras and image analysis computers locate weed position and target herbicide sprays.

The use of weed wiping is currently restricted to glyphosate only. Weeds need to be 8 - 12 inches above the growing crop, and two passes in opposite directions increases success rate. Wipe wiping is good for thistles, which are best treated when flowering, and nettles. Weed wiping is less effective on rushes, docks, ragwort and buttercups. The height differential between some grass weeds, such as black-grass, is not enough to all for the use of a weed wiper. Patch spraying can be used to control problem areas of black-grass and other grass weeds.

On grassland herbicide can be sprayed through a knapsack or from a lance on a quadbike, and used to treat individual weeds such as docks and spear thistle. This causes minimal damage to clover in the sward.

Hand rouging / cutting / digging

Hand pulling of small patches of weeds can be effective, for example to control wild oats and small numbers of herbicide resistant grass weeds like black-grass. The pulled weeds should be removed from the field to prevent further seed spread. Pulling is usually easier when the soil is moist.
Perennial weeds can be directly dug or pulled. Specialised handheld tools have been developed to remove specific weeds e.g. prongs or forks to remove tap rooted weeds such as docks or ragwort.

Harrow / tine weeders (broad spectrum) / mechanical weeding (seedling weeds)

Harrows and tine weeders uproot seedling weeds and cover with a thin layer of soil. These work best where the soil surface has a medium to fine tilth and can be used in all soil types. They disturb the soil at a depth of 2-3 cm and are effective on weeds at the early growth stages (up to 2.5 cm in height) and should be done before the crops get too big to avoid damage. Weeds are generally controlled by burial, but there is some uprooting where working depth and speed of travel are increased. These techniques work best in dry conditions. In grassland this technique can be effective in recently sown leys for weeds with shallow fibrous roots such as chickweed, mayweed and fat hen.

In rowed crop, inter row hoeing can be used as an effective weed control measure. Hoes cuts off weeds at 1-2 cm below the surface and are most effective on loose and moderately fine dry soil. Mounted on the front or rear of the tractor, blades are usually A or L shaped, they work at a depth of 2.5 - 5 cm and cut weeds off at the roots and/or bury them. Discs, plates, or protective hoods can be fitted to protect the crop from damage.

Thermal weed control

Flame weeders have been used successfully in potatoes, field brassicas and apple orchards for the control of small seedling weeds prior to the emergence of the crop. In apple orchards handheld

machinery is currently available to apply hot foam direct to the soil, which kills surface vegetation but does not touch the roots, so is only effective on small annual weeds, both tap and fibrous rooted.

Mowing/topping/crimping/rolling

In grassland the primary action of mowing and topping is to remove the growing point of weeds that are extending above the sward and to prevent flowering. Seed production is prevented and the seedbank is diminished. The timing of mowing and topping is crucial in some species, too early and the weed will branch and produce flowers on a shorter stem, too late and fertile seeds will already have been set. Mowing is regularly used in apple orchards for grass and vegetation management between trees.

Mowing can kill some annual weed species as they are overcome by a competitive grass sward. Ragwort should be cut at the start of flowering, cut material should be removed as it is toxic to livestock. Rushes should be cut prior to flowering; mowing should be repeated to weaken the plant. Bracken should be rolled in early spring to break the new fronds. In cereal crops large patches of weeds such as black-grass can be mown out at heading (may/June) to prevent return of seed.

Early harvest

Cereals can be harvested early to prevent high populations of weeds such as black-grass setting seed.

Re-seeding grassland

Spraying off an established grass ley with glyphosate or ploughing prior to a reseed is an effective method of clearing a field of established perennial weeds.

Bioherbicide

Citronella (Barrier H) can be used in grassland to control ragwort.

Physical mulches

Physical mulches have been used as an effective weed control measure in field brassicas and apple orchards. A thick layer of mulch is used for preventing weed emergence or smothering existing weeds. A good depth of mulch is needed 3 to 4 inches. Mulch needs to be monitored as weeds will start to root on the surface after time and the mulch will need to be replenished.

In apple orchards fabric mulches can be pegged down around trees but a subsequent build-up of organic matter will allow weeds to establish.

Spot treatments in apple orchards

In apple orchards, products such as pelargonic acid, maleic acid hydrazide can be used for spot treatment of weeds like couch, docks and thistles. An electric weeder as a handheld lance is available for spot treatment of individual weeds and is effective on larger weeds both annual and perennial.

Specific weed information

The major arable weeds are the most difficult to control and have specific information sheets on their identification and control.

Brome
https://ahdb.org.uk/knowledge-library/how-to-manage-brome-weeds-in-cereals
Which brome is that? (a concise two-page guide) (2017)
Identification of Brome grasses (a comprehensive four-page guide) (2015)
Identification and control of brome grasses (2014)
Located here https://ahdb.org.uk/knowledge-library/the-weed-resistance-action-group-wrag

Black-grass
Black-grass: Why has this Weed become such a Problem in Western Europe and what are the Solutions? (this paper appeared in Outlooks for Pest Management 2017, published by Research Information)
Black-grass '5 for 5': Integrated weed management for long-term control (2017)
Black-grass – everything you really wanted to know (2013)
Black-grass – the potential of non-chemical control (2013)
Black-grass risk resistance audit (2004)
Located here https://ahdb.org.uk/knowledge-library/the-weed-resistance-action-group-wrag

Wild oats
Identification of wild-oat species (2015)
Dealing with herbicide resistant wild-oats (2001)
Located here https://ahdb.org.uk/knowledge-library/the-weed-resistance-action-group-wrag

Italian ryegrass
Effective, sustainable Italian rye-grass control in winter cereals (2007) Located here https://ahdb.org.uk/knowledge-library/the-weed-resistance-action-group-wrag

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https://ipmtool.net/documents/guidance_weeds.pdf