Agri Services

Bayer Expert Guide

Brome Management in Cereals

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Introduction

Brome grasses are widespread throughout the world, and in some areas, constitute a major weed problem. In Britain there are five species of brome grass that are now considered to be serious arable weeds. These species are not unique to Britain, and can also be found throughout Europe (including the Mediterranean region), North Africa, North and South America, West and South West Asia, and Australia (1).

They are classified into two groups which can be summarised as follows:

Group	Common name	Scientific name
Anisantha	Barren or Sterile brome	*Anisantha sterilis*
	Great brome	*Anisantha diandra*
Serrafalcus	Meadow brome	*Bromus commutatus*
	Soft brome	*Bromus hordeaceus*
	Rye brome	*Bromus secalinus*

In winter cereals, bromes are highly competitive annual (or occasionally biennial) weeds, and high levels of control are required to prevent both yield loss and seed return to the soil (5).

The objective of this booklet is to raise awareness of the problems caused by bromes, to aid their correct identification and improve their control. Integrating cultural methods of control with brome herbicides will offer the best chance of success.

Anisantha – Barren (sterile) brome in a wheat field

Serrafalcus – Meadow brome in a barley field

Meadow brome

Contents

1 Distribution of brome grasses

Brome grasses have not always been a serious arable problem. Essentially plants of field margins, hedgerows and waste places, they have gradually spread from their traditional habitats to form extensions of headland infestations or even distinct and unconnected populations within fields.

In 1989, a BCPC funded survey showed that bromes were widespread, present in around 42% of the 733 cropped fields surveyed. The South East, East and South West of England, the Lothians and Fife in Scotland were the worst affected. Of the five species, barren brome was always the most common (3).

An ADAS survey in 2003 showed the same general trend across 14 counties in England. Barren brome was again the most common, followed by meadow brome and soft brome (4).

Great brome is most widespread in East Anglia and the Weald of Kent, with local infestations in parts of northern England, the Midlands and from Somerset to Devon. It may also be found in a few places along the east coast of Scotland. It is rarely found in Wales (2).

Rye brome is found in small and fairly isolated populations throughout the southern half of England, with only a handful of infestations in northern England, Wales and along the east coast of Scotland (2,14).

Source GfK Kynetec.

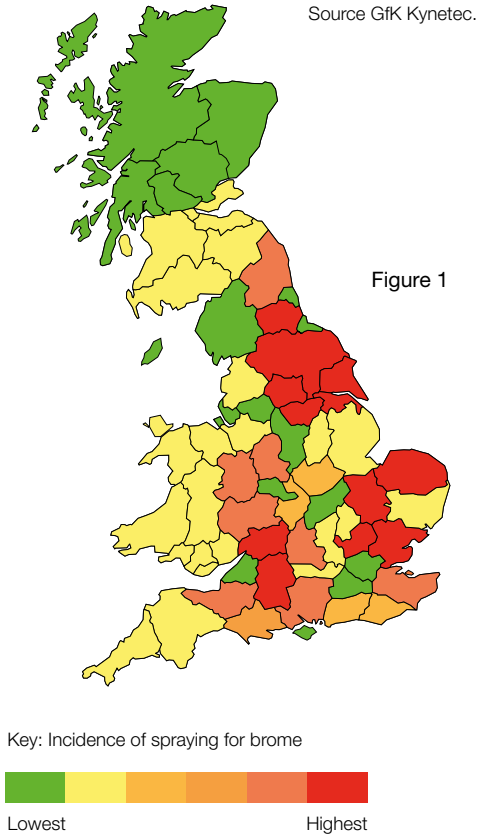


Figure 1

Figure 1: Intensity of herbicide use for brome control in cereals 2011

2 Economic implications of brome infestations

Weed competition can severely impair crop establishment and subsequent growth, resulting in reduced crop yields and poor grain quality. Lodging caused by weeds can make harvesting difficult and time consuming. The incidence of ergot (*Claviceps purpurea*) in cereals can also be increased by the presence of grass-weeds. Brome infestations have the capacity to cause all of these problems.

Of the five species, barren (sterile) brome is the most common in Britain. It is more competitive (plant for plant) than black-grass, but less so than wild oats (8). And, as with black-grass and wild oats, the bromes also have the ability to produce vast numbers of viable seeds (6).

Even at low densities bromes can cause significant crop reductions; populations as low as 5-7 plants/m^2 can reduce winter wheat yields by between 0.5 and 1.0 tonnes/ha. Yield losses at increased brome densities are much higher. Barren brome at 23 plants/m^2 for example, reduced yield by as much as 47% in a low density crop of winter wheat, and 35% in one of high density (9). Barley crops compete with bromes only a little better than wheat (23).

It is therefore important to adopt appropriate practices to control bromes effectively at all available opportunities.

Barren brome

3 Reasons for the spread of brome grasses

Since the mid 1970s, changes to farming practice in winter cereals have resulted in an increase in these competitive weed grasses. Although no single factor appears to be responsible for the spread, those most likely to have contributed are listed below:

Barren brome

1. Long, or continuous, runs of winter cereals, with no rotations to utilise spring cropping
2. Non-inversion tillage or minimum cultivation techniques, without sprayed-off stale seedbeds
3. Earlier sowing of cereal crops
4. Use of non-selective, non-residual herbicides on hedge bases and field boundaries – giving bromes every opportunity to colonise bare ground
5. Cultivating too close to the field boundary, thus moving plants and seeds further into the field
6. Movement of weed-contaminated farming equipment from one field or farm to another
7. Progressive spreading of seed by combine harvesters from field margins further into fields
8. Over-reliance on herbicides alone for brome control
9. Weeds sown with contaminated home-saved seed or by field-feeding brome-contaminated hay
10. Spreading of contaminated manures

4 Growth habit, biology and characteristics of brome grasses

Correct species identification is key in order to ensure that the appropriate weed control strategy is adopted. With bromes, however, correct identification can be difficult, particularly while they are still at the vegetative stage.

When the plants flower in June or July, identification is somewhat easier and subsequent mapping or marking the affected areas on the farm can form the first stage in a control strategy for the next cropping season.

Bromes are highly competitive weeds and, given optimum conditions, each plant has the potential to produce huge quantities of seed (23). Indications of this capability are shown below (6).

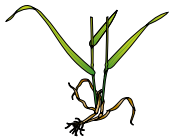
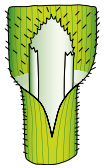
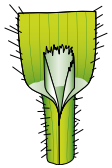
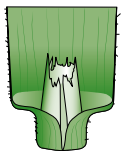
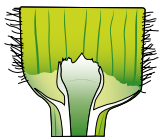
Plant	Seed numbers
Barren (sterile) brome	Up to 5,300
Great brome	Up to 2,700
Meadow brome	Up to 8,300
Soft brome	Up to 9,400

Barren (sterile) and great bromes are winter annuals requiring vernalisation to flower and set seed. And, although most germination takes place in the autumn, a small percentage of seeds are still able to germinate up to two years after shedding (10,11). Seedlings that do emerge in the spring are unlikely to set viable seed (7).

Whilst barren (sterile) and great brome seeds germinate in the dark, prolonged exposure to light will cause the seeds to become dormant (13). As dormancy will vary from population to population, it is possible that sufficient seed from dormant stock could cause problems in the future, even after ploughing (12).

The *Serrafalcus* group (meadow, rye and soft brome), however, are different in this respect as their seeds require 'after-ripening'. In addition, they need light to germinate. As seeds may be viable for 7-10 years, cultivation should ideally be delayed for at least a month following harvest to allow this 'after-ripening' to take place and prevent dormancy.

4.1 Characteristics of brome species

Barren (sterile) brome	Great brome	Meadow brome	Soft brome	Rye brome
				
				
				
Common	Less frequent	Frequent	Frequent	Less frequent
Annual/biennial	Annual	Annual/biennial	Annual/biennial	Annual/biennial
Height 15-100 cm	Height 35-80 cm	Height 40-120 cm	Height 10-100 cm	Height 20-120 cm

Additional characteristics to aid brome identification

Species	Barren (sterile) brome	Great brome	Meadow brome	Soft brome	Rye brome
Leaves					
Colour	Green or purplish	Green	Green	Greenish grey	Green
Characteristics	Finely pointed	Limp	Pointed	Finely pointed	Pointed twisted
Width	2-7 mm	4-8 mm	3-9 mm	2-7 mm	4-10 mm
Length	Up to 25 cm	Up to 20 cm	Up to 30 cm	Up to 20 cm	Up to 25 cm
Leaf Surface					
	Upper: hairy Lower: shiny with some short hairs	Thinly to loosely hairy	Moderately hairy	Soft short hairs	Sparsely hairy, hairy along margins
Ligule					
Length	2-4 mm	3-6 mm	1-4 mm	To 2.5 mm	1-4 mm
Shape	Serrated	Rounded, jagged	Torn	Blunt, serrated	Torn
Leaf Sheaths					
	Pubescent, softly hairy	Loosely hairy – spreading hairs	Hairy to downy Upper: thinly hairy	Softly hairy	Upper: hairless, to light spreading hairs
Panicles					
Seed heads	Open, drooping heads	Open, drooping heads	Upright heads, may droop after flowering	More compact than other bromes	Similar to meadow brome
Length	To 25 cm	To 25 cm	To 25 cm	To 16 cm	To 20 cm
Spikelet					
Length of a unit seed group and awns	Long awned 4-6 cm	Long awned 7-9 cm	Short awned 1.8-2.8 cm	Short awned 1.2-2.2 cm	Short awned 1.2-2.4 cm
Width	6-10 mm	8-12 mm	4.5-6 mm	3.5-6 mm	4-7 mm

Compiled from references (1,20,21,26)

Glossary:

Ligule – Upright pale/white, membranous extension at the junction of the leaf sheath and leaf (blade).

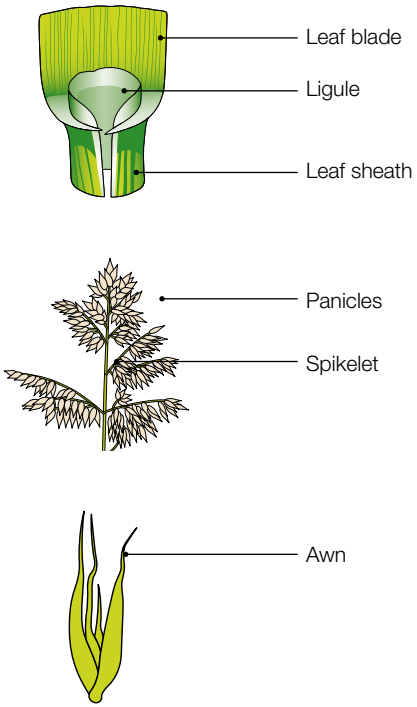
Leaf sheath – Part of the leaf that grasps the stem.

Panicles – The compound flowering head or ear of a grass, to which each spikelet has a distinct stalk attached to the main stem.

Spikelet – Single unit of the grass flower head.

Awn – A bristle coming from the outer covering of the seed.

Compiled from references (1,20,21,26)



5 Integrated brome control: cultural and chemical options

Do not rely on herbicides alone to control or reduce the infestation. Consideration should be given to reducing potential infestations to more manageable levels by cultural means first. Then, by timely applications of targeted herbicides, control the remainder to prevent yield loss and brome seed return – this should give the best chance for long-term success.

5.1 Actions to be taken before harvest

- In June/July, look for any flowering heads of brome grasses
- Mark or map any patches of bromes present and identify the species

5.2 Actions to be taken at harvest

- Consider whether the very badly affected areas are even worthwhile harvesting. If not, deal with these separately to prevent seed spreading from combining operations – possibly by cutting, baling and removing the affected straw
- Remember great brome and rye brome may not have shed seed by harvest and could contaminate the combine with weed seed. This would have the potential to start a new infestation elsewhere
- Try to clean any obvious areas of weed seed contamination within the combine before moving to an uninfested field

5.3 Before storing the combine

- Clean any obvious concentrations of brome and other weed seed contamination within the combine

Soft brome

5.4 Cultural considerations

Different brome species need different strategies.

If the bromes have been identified as:

Barren (sterile) or great brome:

- These germinate in the dark – so consider cultivating as soon as possible after harvest as this will encourage germination. If there is a good covering of chopped straw, cultivation might not be necessary providing there is sufficient moisture for germination
- When their emergence is complete, spray off the weeds with a non-residual, non-selective herbicide such as glyphosate
- If ploughing is contemplated, there should be good inversion of the furrow slice. The depth should be at least 12.5 cm (5") for barren (sterile) brome and at least 25 cm (10") for great brome infestations, to prevent emergence
- The final seedbed should be well consolidated to prevent further emergence of bromes

Meadow, rye or soft brome*:

- These need light and warmth for the seeds to ripen and mature on the soil surface before germination
- After harvest, any cultivation should be left for at least one month to reduce seed dormancy*
- After this time, minimum cultivations to create a stale seedbed can be done. When there is good weed emergence, spray off with a pre-plant treatment of glyphosate
- If ploughing, the furrow needs to be well inverted and deep, to ensure minimal emergence of bromes
- Good consolidation of the seedbed is required to prevent weed emergence

Barren (sterile) brome in wheat canopy

Great brome in wheat. Photo supplied by ADAS

Meadow brome in wheat field

Rye brome in wheat field

Soft brome in wheat canopy

*It should be remembered that seeds of these three species have the potential to become dormant for 7-10 years unless sufficient time (at least a month) is given for them to mature and ripen. If large-scale dormancy of the population occurs, ploughing may present problems for the future, as the seeds are brought back up to the surface (12,15,16).

5.5 Other considerations

Rotations incorporating spring-sown crops:

- As bromes are essentially autumn-germinating weeds, sowing a spring crop (if only in the worst affected fields) will give opportunities to control them more easily. By spring, most of the bromes will have emerged and can be either cultivated out, and/or sprayed off with a non-selective, non-residual herbicide
- Seedbed cultivations should eliminate any late germinating bromes
- Use of an appropriate 'in-crop' herbicide for grass-weed control – this should take into account any herbicide resistance strategy to be employed

Rotational autumn-sown break crops:

Crops such as winter oilseed rape and winter field beans can also give growers additional opportunities to control bromes using selective grass-weed herbicides. In addition, later sown autumn break crops may enable some control of bromes to be achieved by cultural control methods prior to sowing.

Headland and margin management:

Field margins consist of a significant range of habitats – farm tracks, headlands, grass strips, ditches, hedges etc. and all have value in providing a range of different environments for plants, insects, animals and birds.

Sown grass margin strips:

Where bromes are a serious problem along the edge of a field, consider sowing a permanent grass margin strip wide enough to be mown easily. This will create a permanent perennial vegetation barrier against bromes and other invasive annual weeds, such as cleavers (24). Timely mowing, coupled with the competition from within the grass strip, should give long-term control of these weeds (17,18).

Spray drift from some herbicides may cause severe damage to these grass strips and can reduce their effectiveness. Care should be taken when spraying close to them, other vegetation or adjacent crops.

Hedge bases and field margins:

Bare ground, resulting from the spraying of hedge bases and field margins with non-selective, non-residual herbicides, can encourage the presence of bromes and cleavers, especially when conducted early in the season. It can also eliminate other perennial plants that may otherwise help to prevent the encroachment of these, and other invasive annual weeds.

Set-aside:

Studies in the early 1990s found that on long-term set-aside mowing alone did not control brome populations effectively. Even after four mowings, barren brome was still able to set seed, albeit from a shorter stem. Where trailed mowers were used seeding bromes were still recorded in the tractor wheel tracks, indicating that a side-mounted mower might be a better proposition (17,18,19).

Cultivated boundary strips:

Cultivated boundary strips around a field can also be used to keep weeds to a minimum. However, soil disturbance will also allow weeds to germinate given the right conditions (24). Cultivation should therefore be used only as part of an overall strategy to eliminate bromes, not as an isolated operation.

Conservation headlands:

Brome control in conservation headlands can be problematic as it typically requires the use of an in-crop herbicide. Currently none of the permitted herbicide options provide acceptable levels of brome control. Consequently avoid placing conservation headlands where bromes are a problem.

Environmental protection and LERAPs:

As brome infestations are typically in headland areas they are frequently found adjacent to water-containing ditches, streams or ponds. In such situations, as for all pesticide applications, it is essential to avoid spray drift onto the water body. When spraying, direct spray from a horizontal boom sprayer should not be allowed to fall within 5 metres of the top of a bank of a static water body, unless a Local Environmental Risk Assessment for Pesticides (LERAP) permits a narrower buffer zone, or within 1 metre of the top of a ditch that is dry at the time of application (25).

5.6 Chemical control of brome grasses

By now, many of the brome seeds that could have germinated and emerged to form an infestation should already be controlled or buried. The aim should now be to reduce crop competition from "survivors" and also prevent seed shed.

Herbicide resistance:

Whilst there is not currently a problem with herbicide resistance in brome grasses, any strategy that is considered should take account of other annual grass-weeds present in the crop.

In particular some strains of black-grass, wild oats and Italian rye-grass have developed resistance to herbicides, which may lead to poor control. A strategy for preventing and managing such resistance should be adopted.

For further information, consult guidelines issued by the Weed Resistance Action Group (WRAG), copies are available from the HGCA, CPA, your distributor, crop advisor or product manufacturer.

Herbicide options for brome control in cereals:

The information contained within this section is for guidance only and does not constitute any specific recommendation for control of brome grasses in winter cereals. For the latest information on product use, consult your advisor or product manufacturer.

The range of herbicides available for effective 'in-crop' control of bromes is relatively limited. In all cases, available products should only be used as part of an overall brome control strategy incorporating both chemical and cultural control methods. Appropriate herbicide programmes are typically based on the use of an effective pre-emergence herbicide (which can help reduce early weed competition) followed later in the season with an appropriately timed post-emergence herbicide (to maximise control of survivors and later germinating bromes).

Pre-emergence herbicide options:

Traditionally tri-allate (e.g. Avadex) was the foundation of most brome control programmes applied pre-drilling or pre-emergence. However, more recently, various flufenacet-based products (e.g. Liberator, Movon and Vigon) have been used successfully as the pre-emergence component of an overall brome control herbicide programme.

Post-emergence herbicide options:

Reasonable levels of post-emergence control of bromes can be achieved with appropriate use of a range of ALS-inhibiting herbicides as part of an overall brome control strategy i.e. propoxycarbazone-sodium (as Attribut), sulfosulfuron (as Monitor), pyroxsulam (as Broadway Star) and a co-formulation of mesosulfuron and iodosulfuron (as Pacifica).

Note: Some ALS-inhibiting herbicides are only approved for use in the spring (after 1st February).

Remember:

- Only one ALS-inhibitor is permitted per crop, unless the mixture or sequence is approved and listed on the product label
- Individual products must be applied in accordance with directions and restrictions on the product label
- Always follow the manufacturer's guidance in relation to appropriate product usage and supported tank-mixes

6 The use of Pacifica for brome control in cereals

To maximise the level of control from Pacifica, applied in the spring, the following steps should be taken:

- Identify the target brome(s) pre-harvest
- Use cultural methods appropriate to the brome groups, use stale seedbeds or non-residual, non-selective herbicides to clean up emerged bromes, and sow competitive crops/varieties to aid control from later herbicide treatments
- Apply after 1st February when weeds are actively growing and there is adequate soil moisture
- Pacifica is not a standalone treatment for brome control and should only be used as part of an integrated approach, following an effective non-ALS herbicide programme in the autumn
- Suitable autumn treatments would include herbicides based on flufenacet (e.g. Liberator), or tri-allate
- Pacifica must NOT follow earlier treatments (to the same crop) of any ALS-inhibiting grass-weed herbicide, such as a sulfonylurea (e.g. Atlantis WG). Hence, where brome is the key target weed, it is essential that the overall brome control programme is planned prior to initiation. Where it is planned to use Pacifica in the spring the autumn programme must be based on effective non-ALS products

Pacifica

Pacifica is effective against the range of brome species and also against black-grass, rye-grasses and wild oats. It can therefore be used in complex mixed grass-weed situations where bromes are associated with these other grass-weeds.

Pacifica can only be applied in the spring (after 1st February).

Whilst Pacifica can be applied from 1st February it must only be applied when the brome is emerged, has at least 2 leaves, and is actively growing.

Barren (sterile) brome and great brome are moderately susceptible (MS) to 0.5 kg/ha Pacifica applied up to GS 33 of these weeds. Rye brome is also moderately susceptible (MS) to 0.5 kg/ha Pacifica applied up to GS 30 of this weed. However, earlier application to small actively growing weeds will optimise the level of control provided, reduce competition with the crop and help maintain crop yield.

Apply Pacifica as a single treatment at 0.5 kg/ha, plus biopower (the only adjuvant recommended for use with Pacifica).

Pacifica is classified as LERAP Category B and so qualifies for inclusion within the Local Environment Risk Assessment for Pesticides (LERAP) scheme.

Rye brome

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Notes

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