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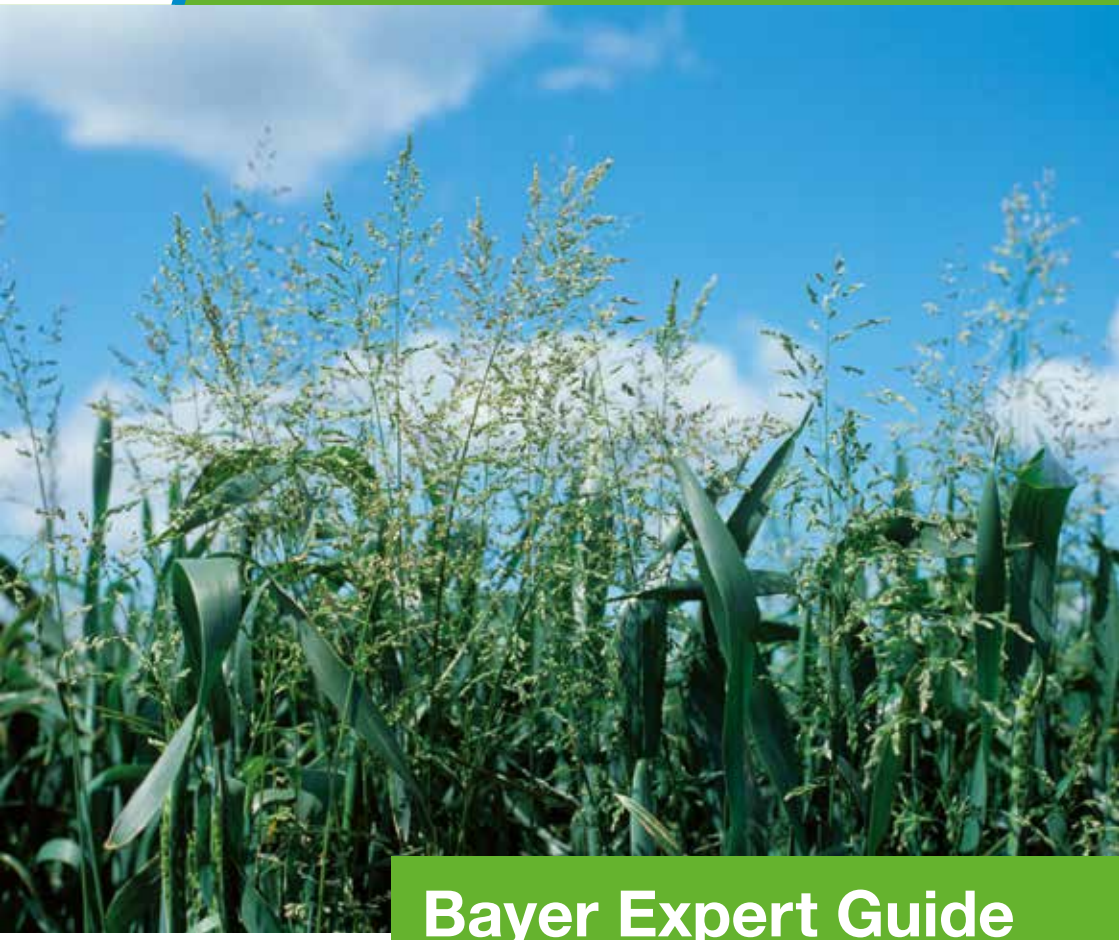

Bayer Expert Guide

Meadow-grass Management in Winter Cereals

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Introduction

The term 'meadow-grasses' refers broadly to a group of around fifteen *Poa* species found in the UK. A few species are widespread and common; others very rare with only three of significant importance to the farmer. These are annual meadow-grass (*Poa annua*), rough meadow-grass (*Poa trivialis*, also known as rough-stalked meadow-grass) and smooth meadow-grass (*Poa pratensis*, also known as smooth-stalked meadow-grass). Of the three, both annual meadow-grass and rough meadow-grass are commonly found as weeds in arable and horticultural crops (1,9,38,41,43).

Although smooth meadow-grass is widespread and frequently found as a constituent of pastures, grassy banks, roadside verges and field margins, it is not usually a serious or persistent problem weed in arable crops (1,41). It is most often seen as an arable weed following ploughed up permanent pastures or grass seed crops (36).

The objective of this booklet is to aid and assist in the identification of these more common meadow-grasses, and give an insight into their distribution and biology, and guidance on their control in winter cereals.

Meadow-grass

Contents

1 Distribution of meadow-grasses

Whilst annual, rough and smooth meadow-grass are widespread and found in every county in the British Isles (2,3), only annual and rough meadow-grass are commonly found in arable crops.

In 1981, a survey of winter wheat and barley crops conducted throughout Central Southern England, reported that meadow-grasses (predominantly annual and rough meadow-grass) were present in 35% of fields throughout the area (24). Subsequent studies have shown that both annual and rough meadow-grass can also be found in spring-sown cereals (9,36,37,43).

A survey in 1991/92 showed annual meadow-grass to be the most common of the three meadow-grasses, being both very frequent and widely distributed in arable fields throughout Britain.

Rough meadow-grass was considerably less common, with the highest frequency being recorded in some areas of mixed farming. The least common was smooth meadow-grass, the highest frequency being found in South East and North Wales – and on average in only around 20% of fields visited. Throughout the remainder of Britain the frequency was around 10-20% of fields infested (30).

Table 1 gives an indication of the areas worst and least affected by these three species.

Table 1: Relative frequency of annual, rough and smooth meadow-grass throughout Britain (1991/92)

Species	Areas recorded as most common	Areas recorded as less common
Annual meadow-grass Common throughout Britain: found in around 40-100% of fields surveyed	Kent, Surrey, Sussex, Hampshire, Isle of Wight, Berkshire, Norfolk, Teesside, Durham, Lancashire, Cumbria, Cornwall, West and North Wales, Northumberland, Dumfries and Galloway	Bedfordshire, Essex, Cambridgeshire, North Lincolnshire and Humberside, South Yorkshire, South Wales, Argyll and Bute
Rough meadow-grass Occurs throughout Britain but only found in 10-60% of fields surveyed	Powys, Isle of Man, Hampshire, Isle of Wight, Berkshire, Kent, Surrey, Sussex, Wiltshire, Avon, East and West Midlands, Gloucestershire	East Anglia, Bedfordshire, Oxfordshire, Somerset, Lincolnshire, South Yorkshire, Lancashire and Cumbria, North Wales, Central and North Scotland
Smooth meadow-grass Occurs across Britain, but only found in a maximum of 20% of fields surveyed	Monmouthshire, Dorset, Berkshire, North Wales and Anglesey, Northumberland and Durham, South West Scotland	Hertfordshire, Nottinghamshire, Bedfordshire

More recently in 1998/99, another survey of 569 arable field headlands in the UK found that annual meadow-grass occurred on around 40% of those covered – making it almost twice as common as rough meadow-grass and almost five times more common than smooth meadow-grass (34).

A survey in 2011 of 1,350 arable farmers in Britain showed that 34% of farms applied herbicides specifically to control meadow-grass species (45) (Figure 1). The darkest red indicates the areas of most intensive herbicide usage specifically for meadow-grass control. The paler areas in the south and east of England however, do not necessarily indicate a low incidence of meadow-grass. It is more likely that herbicides used for other problem grasses, such as black-grass, have also controlled meadow-grasses as a secondary target weed in these counties.

Of the remaining twelve species of meadow-grass found in Britain (Table 2), nine are either rare or very rare – confined mainly to mountainous or rocky areas; and three, whilst frequent, are only found in woodlands, shady areas or on thin, dry soils. All are unlikely to be encountered in arable situations (1).

Source GfK Kynetec.

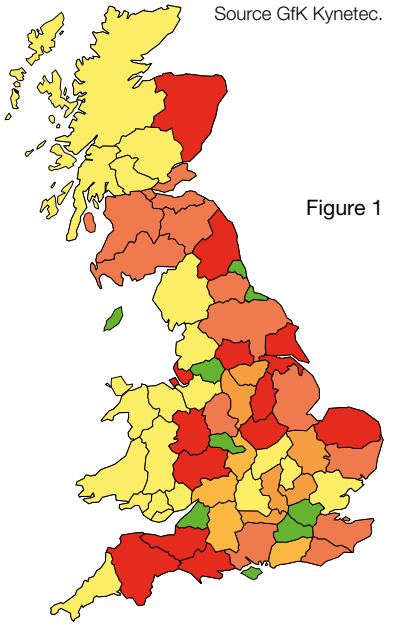


Figure 1

Key: Incidence of spraying for meadow-grasses

Lowest Highest

Figure 1: Intensity of herbicide use for meadow-grass control in cereals 2011

Table 2: Other meadow-grasses (*Poa* spp.) found in Britain

Early meadow-grass	*Poa infirma H.B.K.*	Glaucus meadow-grass	*Poa glauca Vahl.*
Bulbous meadow-grass	*Poa bulbosa L.*	Swamp meadow-grass	*Poa palustris L.*
Alpine meadow-grass	*Poa alpina L.*	Broad-leaved meadow-grass	*Poa chaxii Vill.*
Wavy meadow-grass	*Poa flexuosa Sm.*	Narrow-leaved meadow-grass	*Poa angustifolia L.*
Wood meadow-grass	*Poa nemoralis L.*	Spreading meadow-grass	*Poa subcaerulea Sm.*
Balfour's meadow-grass	*Poa balfouri Parv.*	Flattened meadow-grass	*Poa compressa L.*

2 Economic implications of meadow-grass infestations

Weed competition can impair cereal establishment and growth, resulting in reduced yields or poor grain quality. Where grass-weeds are present in cereals the incidence of Barley Yellow Dwarf Virus (BYDV) and some fungal pathogens, such as ergot (*Claviceps purpurea*), may also be increased. Lodging caused by weeds can also make harvesting difficult, time consuming and reduce grain quality (36).

If uncontrolled, particularly in thin crops and under moist growing conditions, meadow-grasses can rapidly take hold to form a dense mat at the base of the crop.

Even moderate populations of annual meadow-grass can still give rise to a decrease in cereal yields of up to 6%, although with very dense infestations (greater than 1,000 plants/m^2), losses of up to 25% have been recorded under moist conditions (10).

Although not as competitive as some other annual grass-weeds, such as wild oats and bromes, the effects of meadow-grasses on crop yields are not insignificant. Rough meadow-grass for example, is more competitive, plant for plant, than black-grass (9,36).

Of the two 'problem' meadow-grasses, rough meadow-grass is the more competitive. Table 3 compares the competitive effect of some annual grass-weeds on winter wheat yields.

Whilst there is little evidence on the competitive effects of smooth meadow-grass in cereals, it is anticipated that, where it exists, it is likely to be comparable to that of rough meadow-grass, as it is of both similar size and growth habit.

Plant	No. of plants/m^2
Wild oat (*Avena spp.*)	0.5
Brome grasses (*Bromus spp.*)	3
Rough meadow-grass (*Poa trivialis*)	5
Black-grass (*Alopecurus myosuroides*)	8

Table 3: Number of plants shown to give a 2% yield reduction in winter wheat

3 Reasons for the presence of meadow-grasses

In contrast to black-grass and brome grasses, the reasons for the presence of meadow-grasses are less clear-cut.

The increase in frequency of grass-weeds in cereals may be partially attributed to the widespread use of both hormone-based, and other broad-leaved weed herbicides throughout the late 1950's to mid 1960's. It has been suggested their use caused a decline in susceptible broad-leaved species, leaving grass-weeds uncontrolled and with potentially less competition (4,5,6,11).

Annual meadow-grass is found on most soil types and in most situations – especially where land is disturbed. It is dispersed on the wind and by both animal and human intervention. It is therefore unsurprising that it is a very common weed in both UK agriculture and horticulture.

In contrast, rough meadow-grass is essentially a perennial pasture grass that has gradually moved into arable cropping as pastures have been ploughed up, particularly in mixed farming areas. In other areas it has also moved in from grassy field margins and field tracks, being spread by seed and vegetative means (22).

Direct drilling and minimal cultivations also favour the germination and emergence of meadow-grasses, as most of their seeds (being stimulated by light) germinate on or close to the soil surface (7,35). This minimal soil disturbance may also encourage perennial species to regenerate from clumps that are not buried below the soil surface.

Smooth meadow-grass

4 Growth habit, biology and characteristics of meadow-grasses

4.1 Annual meadow-grass

Annual meadow-grass is found across a range of habitats in over 80 countries with temperate climates, and in cooler areas of tropical regions. It is reported to be a weed in over 38 crops worldwide and therefore probably one of the most common grass-weeds in all crops (12,16). It is frequently one of the most common weed seeds found in soil seed banks.

In the UK it exists as both an annual and short-lived perennial, although in arable situations it is most likely to be encountered as an annual plant. As a perennial, it is more commonly found in moist undisturbed, sandy conditions, where prostrate growth allows rooting at the nodes, enabling vegetative spread as well as that from seed (1,11).

It is predominantly a self-pollinating grass. Seeds are spread by wind, human activity, by animals and birds, in water and on farm implements. It is also the most abundant weed seed to be found in soil on footwear (11,19).

Annual meadow-grass germinates throughout the year, with the period of maximum emergence from April through to September, the latter being the optimum time, possibly due to more reliable soil moisture (20,43). After this, as the temperature falls, germination gradually decreases. From the middle of February, germination increases again with rising temperature (7). The minimum temperature for germination is 2-5 ˚C, optimising from around 7 ˚C, through to a high of 35 ˚C (30).

Emergence also increases with increasing soil moisture (up to a maximum of 40% of field capacity), indicating that moisture retentive soils (including those with higher levels of organic matter) may be more prone to annual meadow-grass problems (16). Dry conditions however delay emergence.

Once established, it forms either a loose or compact erect, tufted plant and will flower within 44-55 days of germination (1,15). Because it flowers and seeds throughout the year, both emerging and flowering plants can sometimes be seen in close proximity to each other.

Although annual meadow-grass flowers independently of day length, seed head production is at its maximum in May and June, with seeds becoming viable only 1-2 days following pollination (17,18). It is capable of producing large numbers of seeds; sometimes a single plant may produce up to 13,000 seeds, more under some circumstances.

Annual meadow-grass can be found in winter cereals from autumn onwards (25), frequently on the headland areas of fields. It is also a rapid coloniser of set-aside land (28), although in the long term, and in the absence of bare ground, it may be out-competed by perennial species (26,27).

It does not thrive under drought or very acid conditions, or in soils low in phosphates (21).

4.2 Rough meadow-grass

In contrast to annual meadow-grass, rough meadow-grass is essentially a perennial plant. When mature, it is loosely tufted and spreads by both creeping leafy stolons and seeds. It occurs in a wide variety of habitats, but is more commonly found in pastures, roadside verges, waste-ground, and field margins (22,23,42). Nevertheless, when present in arable crops, plant for plant, it is more competitive than annual meadow-grass.

Flowering occurs mainly in June and unlike annual meadow-grass pollination is primarily by wind. Seeds are shed until August and require vernalisation to flower the following year. Seedlings emerging in the late spring are therefore unlikely to set viable seed.

In cereal crops, rough meadow-grass may produce between 1,000 and 14,000 seeds per plant, but in open situations it can produce twice this number (39). Reproduction from seed therefore is an important factor in the spread of this perennial grass (7).

Seeds germinate under a wide range of temperature and moisture conditions. Those emerging before the winter will have both more, and earlier, flower heads than those emerging during the winter or spring (32). As with annual meadow-grass, the germination of rough meadow-grass seeds is also stimulated by light. Low temperatures have an inhibitory effect on germination (35).

Rough meadow-grass tolerates shade, and grows best on moist, nutrient rich soils that are slightly acid to neutral. It can also be found on clay loam and chalky soils, and only occasionally on sandy soil types. As with annual meadow-grass, it is also sensitive to drought.

4.3 Smooth meadow-grass

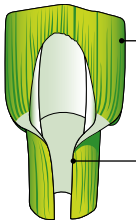
Smooth meadow-grass is also a perennial and, like rough meadow-grass, is common in pastures and undisturbed grassy areas. It spreads essentially by rhizomes rather than stolons, and flowers from May to early July. It is a very variable species with several sub-species, some strains of which may produce viable seed without fertilisation (1). It can survive in poor soils that are moderately acid to alkaline, although it has a preference for light, sandy soils that are well drained and rich in nutrients. It has good drought and cold resistance.

It grows from near sea level up to several thousand feet, and is common throughout Europe, temperate Asia and North America where it was introduced as a sports turf and pasture grass (Kentucky blue-grass). In Britain, some strains are also used in mixtures with other grasses for the same situations (1).

4.4 Identification characteristics of meadow-grasses

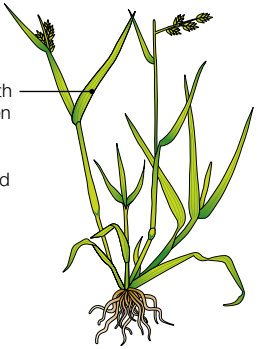
Correct species identification is key to good weed control, although with meadow-grasses this can be difficult while they are still at the early vegetative stages.

Annual meadow-grass (*Poa annua*)



Ligule: Medium: 2-5 mm Roundly pointed and serrated.

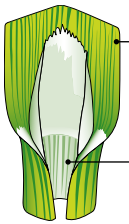
Auricles: Absent.



Leaf blade: Light green with boat-shaped tip. Blade often crinkled or puckered and hairless. It is slightly keeled, with ‘tramlines’ and is folded in shoot.

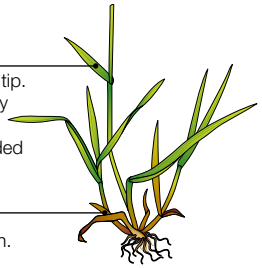
Flowering head: Branched and spreading, triangular in outline. Spikelets are small and awnless.

Rough meadow-grass (*Poa trivialis*)



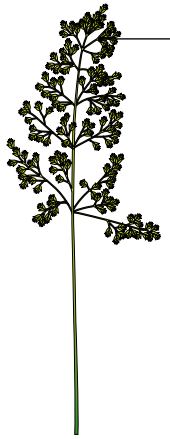
Ligule: Long: 4-10 mm Pointed and membranous. Longest on top leaves.

Auricles: Absent.



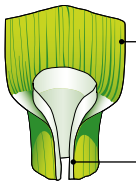
Leaf blade: Green and hairless, with boat-shaped tip. Minutely rough and abruptly pointed. Lower glossy and keeled, with 'tramlines' folded in first, opening later.

Lower stem base leaf sheaths: Usually feel rough. Generally bright green but can be purplish.



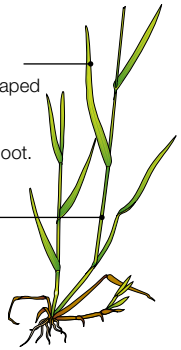
Flowering head: Branched and spreading, but can be contracted and dense. Spikelets are small and awnless.

Smooth meadow-grass (*Poa pratensis*)



Ligule: Lower – very short. Upper – short: 1-3 mm.

Auricles: Absent.



Leaf blade: Dull green or greyish-green with boat-shaped tip. Upper ribless and dull; lower keeled. Hairless with 'tramlines' and folded in shoot.

Lower stem base leaf sheaths: Usually smooth.

Flowering head: Branched and spreading, but can be contracted and dense. Spikelets are small and awnless.

Species	Annual meadow-grass	Rough meadow-grass	Smooth meadow-grass
Scientific name	*Poa annua*	*Poa trivialis*	*Poa pratensis*
Plant	Annual (or short-lived perennial rooting at the nodes)	Perennial with stolons	Perennial with rhizomes
Height (including flower head)	Up to 30 cm	Up to 100 cm	Up to 90 cm
Leaf blade			
Colour	Light green	Green or purplish	Green or greyish-green
Characteristics	Boat shaped tips, blades often crinkled	Acutely pointed boat shaped tips	Pointed or blunt boat shaped tips
Width	Up to 5 mm	1.5-5 mm	2-4 mm
Length	Up to 14 cm	Up to 20 cm	20-30 cm
Leaf surface	Hairless	Hairless	Hairless or minutely hairy
Ligule			
Length	2-5 mm	4-10 mm	Upper 1-3 mm
Shape	Roundly pointed, slightly serrated	Pointed, serrated	Collar shaped, smooth
Leaf sheaths	Smooth	Usually rough	Smooth
Panicles (seed heads)			
Length	Up to 12 cm	Up to 20 cm	Up to 12 cm
Width	Up to 8 cm	Up to 15 cm	Up to 12 cm
Spikelets (length of a unit seed group)	3-10 mm	3-4 mm	4-6 mm

Table 4: Characteristic features of the three key meadow-grass species

Glossary to Table 4:

Stolon – Above ground creeping stem, rooting at the nodes to form further vegetative shoots.

Rhizome – Underground creeping stem, rooting at the nodes to form further vegetative shoots.

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.

Panicle – 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 grass flower head.

(Compiled from 1,12,13,14,31.)

5 Meadow-grass control

It was not until the late 1960's and mid 1970's when the first of the selective, broad-spectrum, substituted urea herbicides were introduced into cereals, for example metoxuron, chlorotoluron (CTU) and isoproturon (IPU). Control of annual grass-weeds in cereals then became a more common practice (7,8).

For many years it has been considered critical to control wild oats, cleavers, bromes and black-grass in winter cereals. Control of other weeds such as meadow-grasses, mayweeds, poppies, Italian rye-grass and volunteer rape and beans should also be considered a priority where they are a problem (40).

Like most other weeds, meadow-grasses rarely grow in isolation and may be found with both broad-leaves and other grasses. In the very early stages of growth, meadow-grasses are relatively easy to control with appropriate herbicides, but once established, or as mature perennials, control becomes much more difficult.

5.1 Preventing new infestations

After ploughing up established pastures, ensure any clumps of surviving grasses are killed before sowing the next crop. This is particularly important in the case of both rough and smooth meadow-grass, as these can form the basis of future weed infestations.

Before moving from field to field, or storing the combine, clean any obvious concentrations of weed seeds and crop residue from within the combine. This will help to reduce the transference of weed and (volunteer) crop seeds from one field to another.

The onset of meadow-grass problems may be reduced by:

- Sowing spring cereals or other spring crops in the rotation
- Delaying the final cultivations of ploughed pasture or old infested grass-seed crops (32)
- Including cultivated boundary strips around a field, used as part of an overall strategy to prevent the encroachment of weeds, rather than as a single operation

5.2 Herbicide resistant weeds

There are confirmed strains of annual meadow-grass resistant to herbicides (mainly paraquat) in orchards. There is NOT, however, currently a problem with herbicide resistant meadow-grasses in arable situations in Britain.

Whilst this is the case, any herbicide strategy considered should take account of any other annual grass-weeds present in the crop.

Some strains of other grass-weeds, e.g. black-grass, wild oats and Italian rye-grass, have developed resistance to herbicides in arable crops; this may lead to poor control. If they are present, a strategy for preventing and managing such resistance should be adopted as appropriate.

It should be noted that, unless CRD have granted approval for a sequence, only one application of an ALS inhibiting grass-weed herbicide should be made to the crop throughout its growing season.

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

5.3 Key herbicides available for the control of meadow-grasses

The information contained within this sub-section has been taken from a number of sources; it is for information only and does not constitute any specific recommendation for the control of meadow-grasses or other weeds in winter cereals.

A number of active ingredients are available for the chemical control of meadow-grasses and other weeds in cereals (29). The list provided is not exhaustive and serves only to give an indication of the herbicides currently available at the time of going to press. The levels of control provided by these herbicides differ depending on a range of factors including the intrinsic level of activity of the herbicide and the growth stage of the meadow-grass at application. Also note that not all the herbicides listed are effective against both the major meadow-grass species (annual and rough).

Restrictions may apply to application timings, crops and following crops. In all cases either check with your advisor or follow guidelines provided in product literature or on the product label. Individual products must be applied in accordance with directions and restrictions on the product label. Always read the label and product information before use. Use plant protection products safely. Where tank-mixes are used, the manufacturers' recommendations should always be followed.

Residual herbicides

Residual herbicides can provide control of meadow-grasses emerging after application and, as such, are a valuable component of a control programme when applied either pre-emergence or very early post-emergence. For any soil acting herbicide, seedbed preparation is particularly important to get the optimal level of control. Accumulations of chopped straw or crop residue should be buried, or spread as thinly as possible, following cultivation. Ideally, clods should be smaller than 2-3 inches (5-8 cm) in diameter and the seedbed consolidated. For pre-emergence applications a moist soil surface with some rainfall soon after application will also help maximise the level of control provided.

Chlorotoluron (CTU) – A contact and residual urea herbicide available in mixture with pendimethalin and diflufenican effective against meadow-grasses and a range of broad-leaved weeds. Follow stewardship guidelines to avoid movement of CTU to surface waters.

Isoproturon (IPU) – A contact and residual urea herbicide for use in a number of cereal crops. It is active against meadow-grasses, including rough meadow-grass, and a limited range of broad-leaved weeds. Follow stewardship guidelines to avoid movement of IPU to surface waters.

Diflufenican (DFF®) – A residual, shoot absorbed herbicide for mainly broad-leaved weed control in winter cereals with some activity on meadow-grasses. For broad spectrum control it is formulated with other herbicides including flufenacet (e.g. Liberator) and flurtamone (e.g. Bacara).

Flufenacet – A residual oxacetamide herbicide for pre and early post-emergence grass-weed control in winter wheat and winter barley. Available in mixtures (e.g. with diflufenican as Liberator) it can provide high and consistent levels of control of both annual and rough meadow-grasses.

Flurtamone – A residual, primarily root absorbed, bleaching herbicide for pre and early post-emergence grass and broad-leaved weed control in cereals. Available only in mixtures (e.g. with diflufenican as Bacara) it provides moderate levels of control of meadow-grasses and is typically used in tank-mixes or sequences with other herbicides for improved levels of control. Also available in co-formulation with flufenacet + diflufenican as Movon/Vigon it enhances further the consistent level of control provided by the other component actives.

Pendimethalin – A residual dinitroaniline herbicide for use in cereals and other crops. It is effective, pre-emergence, against annual meadow-grass but rough meadow-grass is less susceptible. It should be applied as soon as possible after drilling, as its efficacy is reduced against emerged grass and broad-leaved weeds where used alone. Also available co-formulated with flufenacet, which provides improved levels of control of meadow-grasses, or with picolinafen for improved levels of post-emergence control.

Prosulfocarb – A thiocarbamate herbicide for both pre and early post-emergence weed control in cereals. It controls both annual and rough meadow-grass and a limited range of broad-leaved weeds. Typically recommended in tank-mix with diflufenican or pendimethalin for improved levels and spectrum of control.

Post-emergence herbicides

Clodinafop-propargyl – A foliar applied 'fop' herbicide (ACCase inhibitor) providing post-emergence control of annual grass-weeds but with no residual control, nor control of broad-leaved weeds. It is effective against rough meadow-grass, but not against annual meadow-grass.

Flupyrsulfuron-methyl – A sulfonylurea herbicide (ALS inhibitor) used for the pre and post-emergence control of annual grass and broad-leaved weeds in winter wheat (and pre-emergence only in winter barley). Active by a combination of foliar and root uptake, its post-emergence efficacy is enhanced by moist soil conditions. Meadow-grasses are only moderately susceptible to flupyrsulfuron-methyl.

Mesosulfuron-methyl – A sulfonylurea herbicide (ALS inhibitor) providing post-emergence control of a wide range of annual grasses in winter wheat, including both annual and rough meadow-grass. It currently provides the most robust post-emergence treatment for meadow-grass control up to tillering stages. Mesosulfuron is available in mixture with iodosulfuron and diflufenican (as Othello) for the post-emergence control of meadow-grasses and a range of broad-leaved weeds in winter wheat.

Pinoxaden – A phenylpyrazoline herbicide (ACCase inhibitor) controlling annual grasses in winter wheat, winter barley and spring barley. It can provide control of rough meadow-grass, but does not control annual meadow-grass or broad-leaved weeds.

6 Use of Othello for control of meadow-grass in winter cereals

Othello is a post-emergence herbicide that delivers the most effective and consistent control of emerged annual and rough meadow-grass in winter wheat when used appropriately. In addition it controls a wide range of key broad-leaved weeds frequently found in association with meadow-grass infestations. This section provides a brief summary of the information relating to the effective use of Othello (mesosulfuron + iodosulfuron + diflufenican).

Efficacy

- For the most consistent post-emergence control of meadow-grass, apply Othello at 1.0 L/ha with the adjuvant biopower at 1.0 L/ha up to early tillering (GS 23) of meadow-grass ensuring good spray coverage of the weeds
- Othello should be applied to young actively growing weeds for maximum efficacy and when the majority of meadow-grass has emerged, typically in the autumn
- As meadow-grass infestations frequently consist of plants at various growth stages, aim to apply Othello prior to tillering, as later applications may result in some plants beyond susceptible growth stages and reduce levels of control
- Othello applied beyond early tillering of meadow-grass, or in the spring, can reduce profitability due to poorer control and/or reduced yields

Crop tolerance

- Avoid application to 'soft' crops as crop effects (yellowing) may be observed following treatment, particularly on spray overlaps and for late season/spring applications. These effects are transitory in nature and will normally have no adverse effect on grain yield

Resistance management

- Due to the risk of resistance development in other annual grass-weeds do not use Othello specifically for the control of annual grass-weeds other than meadow-grasses. Where weeds such as black-grass are present in significant numbers, the use of an alternative product (e.g. Atlantis WG) will be more appropriate
- Do not use any other grass-weed active ALS inhibiting herbicide in sequence or tank-mix with Othello unless the ALS sequences/tank-mix is approved by CRD
- Do not use Othello as the sole means of grass-weed or broad-leaved weed control in successive crops. Always use grass and broad-leaved weed herbicides with non-ALS modes of action throughout the cropping rotation
- Monitor weed control effectiveness and investigate any odd patches of poor grass or broad-leaved weed control. If unexplained a resistance test may be appropriate

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