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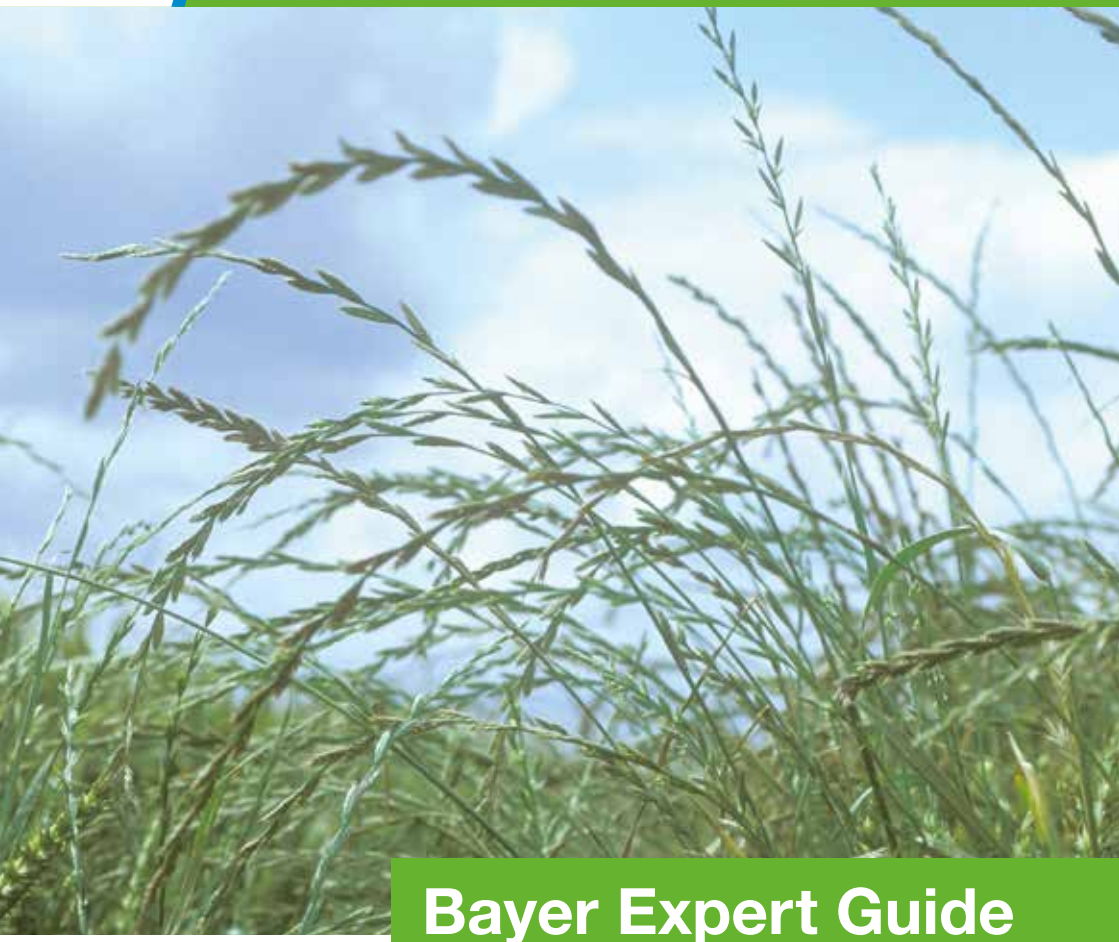

Bayer Expert Guide

Rye-grass Management in Cereals

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Atlantis and Pacifica contain mesosulfuron-methyl and iodosulfuron-methyl-sodium.
Bacara contains diflufenican and flurtamone.
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Liberator contains diflufenican and flufenacet.

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Introduction

Whilst not as widespread as other grass-weeds such as black-grass (*Alopecurus myosuroides*) and wild oats (*Avena* spp.), rye-grass (*Lolium* spp.) presents a serious local problem in some areas of the UK.

Both Italian (*Lolium multiflorum*) and perennial rye-grass (*Lolium perenne*) are well distributed throughout the UK. However it is Italian rye-grass that probably represents the greater weed threat in arable crops. The areas at most risk are where a mixture of stock, arable and grass seed production co-exist.

The objective of this booklet is to improve awareness of rye-grasses as a weed in cereal crops, to aid correct identification and to provide recommendations to maximise weed control under a range of situations.

Rye-grass

Contents

1 Distribution of rye-grass

Rye-grass is a major constituent of short-term grass leys in some arable rotations and consequently has widespread distribution. It has been recorded, to a greater or lesser extent, in virtually all counties of England, Wales and Scotland. Figure 1 is based on data collected from farmers who identified rye-grass as a weed that they needed to control. For the whole of the UK this represents 140,000 ha. Whilst this is a small percentage of the total grass-weed market, it still presents a major problem for many farmers with rye-grass.

A survey conducted in 1988 (1,4) reported rye-grass to be present in around 14% of winter cereal and 13% of spring cereal crops in the UK (about one third of the area infested with black-grass). Just 3 years later its presence was recorded as having risen to 25% of fields (2). The worst affected counties were Avon, Wiltshire and the West Midlands (around 40% of farms affected), with a band of lesser infestation running north to south from the Borders to the south coast, including the counties of Dorset and Hampshire.

Eastern England has tended to the show the lowest incidence of weed rye-grass – with around 10-20% of farms affected (2). Nevertheless, the demand for control in the Eastern Counties is frequently greater than that for other areas, perhaps due to the density of the populations observed and their threat to yield.

More recently a survey in 2011 of 1,350 arable farmers in Britain showed that 12% of farms applied herbicides specifically to control rye-grass. The map shows the intensity of herbicide use specifically for rye-grass control.

Source GfK Kynetec.

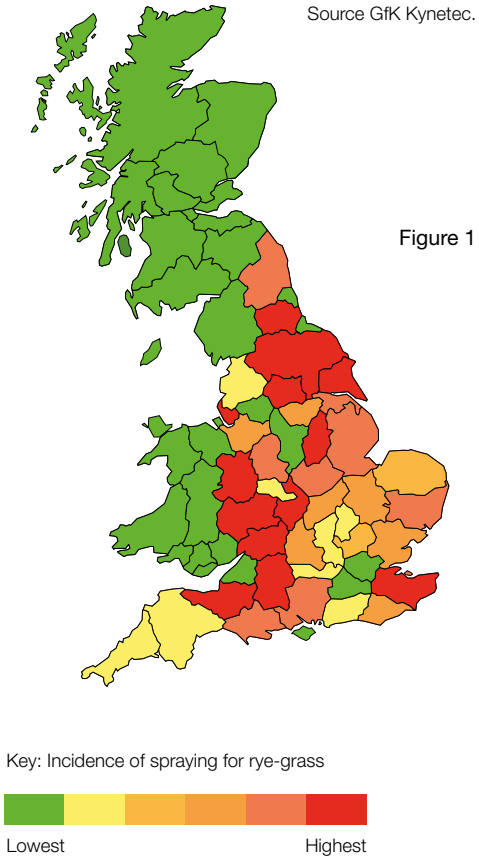


Figure 1

Figure 1: Rye-grass control intensity of herbicide use 2011

2 Economic implications of rye-grass infestations

It is well known that serious weed competition can severely reduce both crop yield and quality. Whilst broad-leaved weeds are easily visible, grass-weeds are sometimes missed or overlooked – especially when small or within the crop rows. Despite this, they still have the capacity to reduce crop yield.

Rye-grasses compete with a crop to roughly the same extent as sterile (or barren) brome and rough meadow-grass – whilst other grasses, notably common couch, loose silky-bent and annual meadow-grass, are generally less competitive. However, in those areas where rye-grass is a serious problem, substantial yield losses can occur.

Little information on the impact of rye-grass infestation on cereal yield is available. Some consider that low populations of rye-grass (up to 50 plants/m^2) will have only a low to moderate effect on yield, whilst larger populations (60 plants/m^2 and above) will reduce yields dramatically (3). In contrast, other data has indicated that with as few as 5-7 rye-grass plants/m^2, yield losses in the order of 5-15% may result (9,10,12). What is clear is that due to the ability of rye-grass plants to tiller extensively, depending on the situation, even a few heavily tillered plants/m^2 may adversely affect grain yields.

3 Reasons for the presence of rye-grass

The main reasons for the introduction of rye-grass as a problem weed are:

- Seed return to the soil from rye-grass seed crops
- Ploughed-in seeds in animal dung from field fed hay/silage or grazing
- Use of farmyard manure or slurry in an arable rotation

4 Growth habit, biology and characteristics of rye-grass

Correct weed identification is essential in order to decide on an appropriate strategy for control. Whilst rye-grasses have several key characteristics to aid their identification, confusion often exists between Italian and perennial rye-grass. The following section provides a basic guide to the biology and appearance of these two species.

4.1 Italian rye-grass

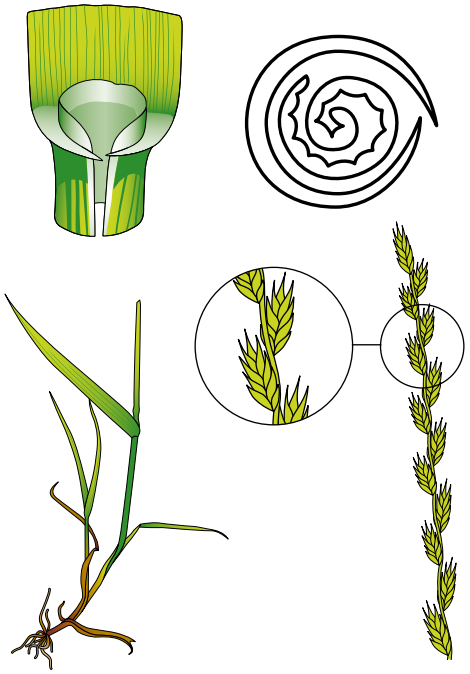
Growth habit:

Italian rye-grass can be an annual or biennial plant. It can be anything from 30-100 cm tall, either as a tufted, heavily tillered plant or with a solitary stem, and either erect or spreading in nature, depending on the situation. Germination may occur from the autumn right through to early spring (October-March). Flowering is relatively early, occurring between late May-August. More importantly seed is shed before cereal harvest. The seeds may become dormant and persist in the soil for periods of up to 7 years. As a result it may be found as a volunteer weed in several successive arable crops following an original infestation.

Identification:

Leaf blades are green and hairless with a smooth and glossy under-surface. Whilst variable in length they typically range from 6-25 cm long and may be up to 10 mm wide. The blades are finely pointed at the tip and are rolled in the sheath. The base of the stem is green or purplish.

The ligule of Italian rye-grass is typically 1-2 mm long with narrow spreading auricles. Italian rye-grass spikelets on the seed head are arranged alternately along the length of the head and are awned.



Italian rye-grass

4.2 Perennial rye-grass

Growth habit:

Perennial rye-grass as the name indicates is a perennial plant. It can be anything from 10-90 cm tall, as a loose or densely tufted plant and either erect or spreading in nature, depending on the situation.

Whilst competitive, perennial rye-grass is typically not as aggressive as Italian rye-grass early in the season.

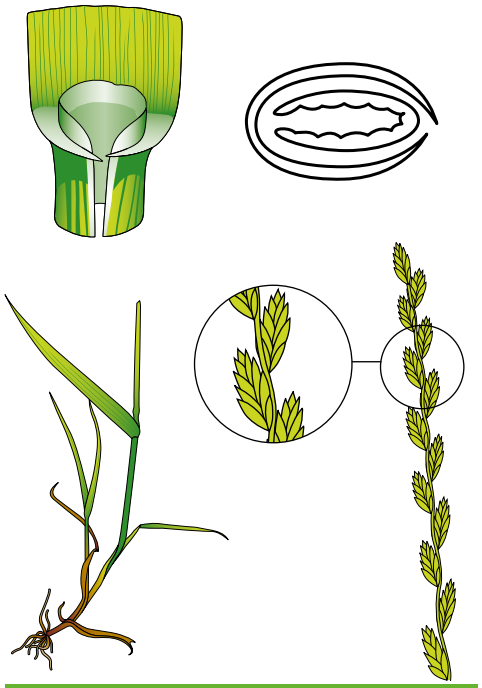
In contrast to Italian rye-grass, whilst early flowering perennials can shed seed before the cereal harvest, late flowering types may not complete their life cycle before harvest.

As for Italian rye-grass, seeds may become dormant and persist in the soil. However, they are shorter lived and seeds of perennial rye-grass are only likely to survive for 2 and occasionally up to 4 years in the soil.

Identification:

As for Italian rye-grass, leaf blades of perennial rye-grass are green and hairless being smooth and glossy below. They vary considerably in length (3-20 cm long) but tend to be narrower – typically 2-6 mm wide. The leaf blades may be pointed (as for Italian rye-grass) or blunt at the tip, with the young leaves folded in the sheath. The base of the stem is green or purplish to pink. The ligule of perennial rye-grass is up to 2 mm long with small narrow auricles.

Like Italian rye-grass the spikelets on the seed head of perennial rye-grass are arranged alternately along the length of the head. However in contrast the spikelets of perennial rye-grass are not awned.



Perennial rye-grass

4.3 Hybrid rye-grass

Clear identification of rye-grasses is further confused by the fact that where plants of both Italian and perennial rye-grass co-exist, the two species readily hybridise. The resulting hybrids may have a combination of characteristics from both Italian and perennial rye-grass. For example they may have either awned or awnless spikelets. The leaf blades of such hybrids are usually rolled within the shoot, similar to those for Italian rye-grass.

These hybrid plants can be annual, biennial or short-lived perennials. Most hybrids produce rapid and leafy growth and are therefore similar to Italian rye-grass in this respect.

5 Integrated rye-grass control

5.1 Herbicide resistance status in rye-grass

Herbicide resistance to ACCase inhibiting herbicides (fops/dims) was first recorded in rye-grass in 1987 in Oregon, USA (7). In 1990 herbicide resistance also became apparent in the UK and, by 1999, resistance to diclofop-methyl had been confirmed in populations of Italian rye-grass on 30 farms across 12 counties. By 2004, 324 cases of herbicide resistance in Italian rye-grass had been confirmed in 28 counties (13,15). Herbicide resistant Italian rye-grass is therefore now present in most areas of England (14). It is currently not as widespread as resistant black-grass or wild oats, but nevertheless presents a serious problem where it occurs.

Both enhanced metabolism and target site (ACCase) resistance mechanisms have been identified in Italian rye-grass (15). Enhanced metabolism appears to be the major mechanism and it has been shown to reduce the efficacy of both diclofop-methyl and tralkoxydim. Herbicides whose peformance is little or unaffected by this mechanism include flufenacet and flurtamone. Populations with target site resistance have demonstrated resistance to cycloxydim. Also, populations with resistance to diclofop-methyl have been shown to have cross resistance to fluazifop-p-butyl, quizalofop-p-ethyl and tralkoxydim.

Whilst present in other parts of the world, target site resistance to ALS inhibiting herbicides (e.g. sulphonylureas) is not commonly found in Italian rye-grass in the UK.

Herbicide resistance in perennial rye-grass occurs much less frequently than in Italian rye-grass.

Ultimately, minimising the onset of herbicide resistant weeds will be cheaper and easier than managing resistant weed populations – a lesson that has been learnt in the control of black-grass. Recommendations to optimise the control of rye-grass and anti-resistance strategies are dealt with in the following pages.

5.2 Optimising rye-grass control in cereal crops

Experience over many years has shown that weed control, particularly that of annual grasses, is better done on an integrated basis, rather than just relying on herbicide treatment alone. Anticipated high populations of grass-weeds should also be controlled early on and before crop establishment is compromised.

For rye-grass, as for other grass-weeds where herbicide resistance is known to occur, any control measures undertaken should be in line with guidelines published by WRAG (Weed Resistance Action Group) (15) or by HRAC (Herbicide Resistance Action Committee) (8).

5.3 Cropping and cultural control of rye-grass

In situations where there is a mixed grassland and arable rotation, seed return to the soil during the grassland phase should be minimised in order to reduce seed carry over into successive arable crops. In this respect grazing and cutting dates can have a great effect on seed return. Where possible the use of Italian rye-grass in the grassland phase should be avoided. Similarly, set-aside green cover ideally should not be based on Italian rye-grass.

Cultivation can be used to help manage existing infestations of rye-grass. Whilst germination of rye-grass seed occurs over an extended period, some reduction in population can be achieved by the use of stale seedbeds. Also, following a grass ley, ploughing down of shed seed and subsequent shallow cultivation in successive cropping seasons will help reduce the survival of shed seed. Adjusting the crop rotation to incorporate broad-leaved crops not only provides greater opportunities for the use of cultural control methods but also widens the range of herbicides that may be used.

5.4 Chemical control of rye-grass

Clearly the destruction of a grass sward with a non-selective herbicide prior to ploughing is of value, primarily in preventing the survival of established plants in subsequent cultivations. The selective chemical control of such established plants in a cereal crop situation is very difficult and the need to do so should be avoided where possible.

No weed control strategy should rely on the use of herbicides alone. Nevertheless, having taken appropriate measures to reduce the weed potential prior to sowing by cropping and cultural methods (15), an optimised herbicide treatment will provide the maximum level of rye-grass control.

As rye-grass can germinate over a protracted period during autumn, a herbicide treatment with residual activity will ensure continued effects on later emerging seedlings. However, in a situation where a high number of rye-grass seedlings have emerged, or where a herbicide application is made later in the season, a contact herbicide can prove most effective. An assessment of the likely requirement for residual and contact efficacy is essential in order to identify the most appropriate herbicide strategy for optimal rye-grass control.

6 Active ingredients available for the control of rye-grass in cereals

The range of active ingredients available for the control of rye-grasses is relatively limited. Additionally, due to the increase in herbicide resistant populations of Italian rye-grass, the effectiveness of some of these actives is declining. The following list is not exhaustive, but contains the major actives currently used for rye-grass control in cereals.

Flufenacet is a residual herbicide which is most effective when applied pre-emergence of rye-grass. Flufenacet provides an effective start to a rye-grass herbicide programme controlling the majority of plants emerging in the autumn. As flufenacet is not affected to any great extent by herbicide resistance it is a valuable component of any resistance management strategy. Flufenacet is available in mixtures e.g. with diflufenican as 'Liberator' or with diflufenican and flurtamone as 'Movon' and 'Vigon'.

Prosulforcarb exhibits residual efficacy against rye-grass and is most effective when applied pre-emergence as part of a herbicide programme incorporating effective post-emergence treatments.

Pendimethalin is a residual herbicide which, when in association with other effective herbicides, enhances the residual control of rye-grass emerging after application.

Flurtamone is a residual herbicide providing some control of rye-grasses when applied in association with other effective active ingredients (e.g. with diflufenican and flufenacet as in 'Movon' and 'Vigon').

Pinoxaden is a contact acting ACCase inhibiting herbicide which does not provide residual control. As such it will control emerged rye-grass plants but, if used alone, will not control seedlings emerging after application. However, products based on contact acting actives typically control later stages of rye-grass than do residual products. As pinoxaden is an ACCase inhibitor, some populations of Italian rye-grass have shown both ACCase Target-Site and Enhanced Metabolism resistance to it (14). Where resistance is suspected, the susceptibility of the population to products containing these active ingredients should be assessed before their use.

Mesosulfuron, iodosulfuron and pyroxsulam are ALS inhibiting herbicides which act primarily by foliar uptake and have limited residual efficacy. Consequently, if used alone, they will not control seedlings emerging after application. As for ACCase inhibitors, whilst ALS inhibiting herbicides are affected by Enhanced Metabolism resistance in rye-grass, they are not typically affected by ALS Target-Site resistance (14).

7 Chemical weed control strategies for rye-grass

The choice of products and rates depends primarily on:

- The timing of application
- The growth stage of rye-grass
- The population present
- The extent to which control of later germinators is required

Typically, early applications require a residual component. With later applications where the rye-grass is at a more advanced growth stage, a contact component is required. Later applications of contact materials may be applied with or without the addition of a residual material depending on the requirement for control of rye-grass germinating after application.

The following tables give some basic guidance on a selection of treatments available for rye-grass control. Always consult the product label and/or literature for detailed recommendations and any restrictions.

Note: The presence of herbicide resistant populations of Italian rye-grass may lead to reduced levels of post-emergence control. In order to achieve acceptable levels of control of rye-grass the adoption of an appropriate herbicide programme is required in many situations.

Pre-emergence treatments available as part of an overall rye-grass control programme:

Treatment (rate per ha)	Latest stage controlled	Notes
Liberator (0.6 L) alone	Pre-emergence	Use only as part of an overall rye-grass control programme
or + pendimethalin (PDM) (up to 1,200 g)	Pre-emergence	Abide by seasonal dose restrictions for PDM
or + prosulfocarb (up to 1,600 g)	Pre-emergence	Pre-em use in winter wheat only
Flurtamone + DFF Bacara (0.25-0.5 L)	Pre-emergence	Pre-em use. Max of 0.25 L/ha Bacara on winter barley
Movon/Vigon (1 L) alone	Pre-emergence	Use only as part of an overall rye-grass control programme

Post-emergence treatments available for the control of rye-grass up to tillering stages as part of an overall rye-grass control programme in winter wheat typically following an effective pre-emergence herbicide:

- In order to control rye-grass germinating after application, an autumn treatment comprising a contact material such as mesosulfuron and iodosulfuron (e.g. Atlantis WG) in tank-mixture with a residual herbicide based on flufenacet prosulfocarb or pendimethalin can provide the best option for control in winter wheat

Treatment (rate per ha)	Latest stage controlled	Notes
Atlantis WG (400 g) + prosulfocarb (1,600-2,400 g) + biopower (1 L)	GS 30	Apply in autumn/end of winter when there is active growth of rye-grass
Atlantis WG (400 g) + 0.6 L/ha Liberator	GS 30	Apply in autumn/end of winter when there is active growth of rye-grass
Atlantis WG (400 g) + pendimethalin (min. 960 g) + biopower (1 L)	GS 30	Apply in autumn/end of winter when there is active growth of rye-grass. Abide by occasional date restrictions for pendimethalin
Pacifica (400-500 g*) + biopower (1 L)	GS 32	Use only after an effective non-ALS autumn herbicide programme. Apply in early spring (after Feb 1st) when there is active growth of rye-grass

*500 g rate of Pacifica is approved for use in mixed grass-weed situations where brome is the overwhelming constituent of the mixture

The following gives guidance on the appropriate treatments to consider in high rye-grass populations or in resistant situations:

- In situations where rye-grass control has been historically difficult (due to either high populations or presence of herbicide resistant strains) a sequence of herbicide treatments is likely to be required in order to provide an acceptable level of rye-grass control
- In known difficult rye-grass control situations always start your rye-grass control programme with a pre-emergence herbicide treatment based on flufenacet (e.g. Liberator)

Note: Optimal levels of control will be obtained where applications are made to young, actively growing weeds at stages before the latest growth stage indicated below, typically within the range GS 12-23.

- As the effectiveness of most rye-grass herbicides is reduced at later growth stages (particularly in resistant situations) herbicide applications should ideally be made at, or before, the early tillering growth stage of rye-grass (up to GS 21-23) provided that environmental conditions are suitable for optimal efficacy (consult individual product labels for guidance)

Note:

- Individual products must be applied in accordance with directions/restrictions on the product label
- Italian rye-grass infestations containing enhanced metabolism herbicide resistant populations will result in reduced levels of control
- Italian rye-grass infestations containing target site herbicide resistant populations will result in reduced and potentially unacceptable levels of control from treatments with ACCase inhibiting herbicides
- In cases where resistance is confirmed, or suspected, irrespective of population numbers, all treatments must be preceded by an effective pre-emergence and/or early post-emergence residual treatment

Rye-grass

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Notes

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