Bayer CropScience

Expert Guide: Ryegrass Management in Cereals

weed focus

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Introduction

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

Both Italian (*Lolium multiflorum*) and perennial ryegrass (*Lolium perenne*) are well distributed throughout the UK. However it is Italian ryegrass 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 ryegrasses as a weed in cereal crops, to aid correct identification and to provide recommendations to maximise weed control under a range of situations.

Ryegrass distribution across the UK

Ryegrass 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 ryegrass 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 ryegrass.

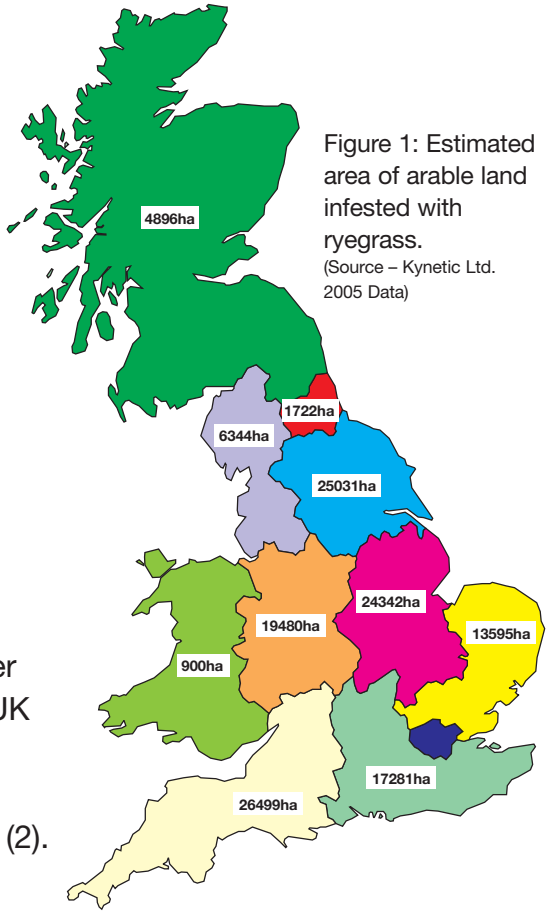


Figure 1: Estimated area of arable land infested with ryegrass.
(Source – Kynetic Ltd. 2005 Data)

A survey conducted in 1988 (1,4) reported ryegrass 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 ryegrass – 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.

Causes of ryegrass infestations

The main reasons for the introduction of ryegrass as a problem weed are:

- Seed return to the soil from ryegrass 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

The economic penalties of ryegrass as a weed

It is well known that serious weed competition can severely reduce both crop yields 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.

Ryegrasses 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 ryegrass is a serious problem, substantial yield losses can occur.

Little information on the impact of ryegrass infestation on cereal yield is available. Some consider that low populations of ryegrass, (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 ryegrass plants/m^2, yield losses in the order of 8.5%-15% may result (9,10). What is clear is that due to the ability of ryegrass plants to tiller extensively, depending on the situation, even a few heavily tillered plants/m^2 may adversely affect grain yields.

Biology, growth habit and identification characteristics

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

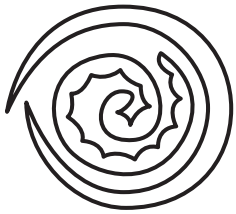
Italian ryegrass

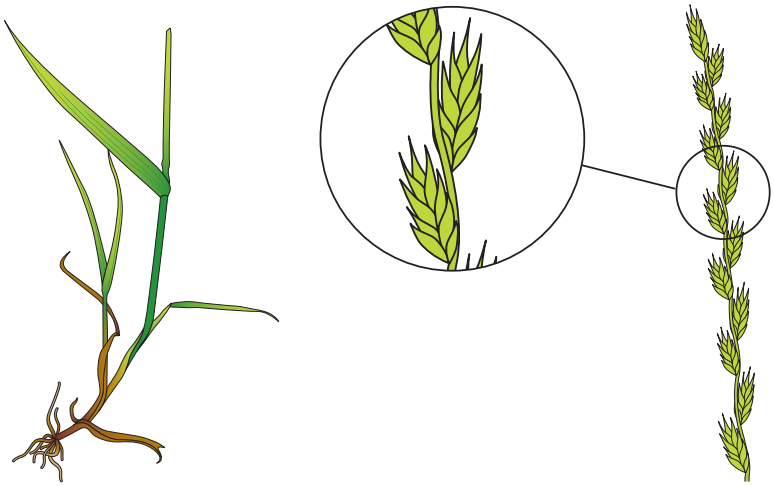
Growth habit:
Italian ryegrass can be an annual or biennial plant. It can be anything from 30-100 cm tall, either as a tufted, heavily tillered plant or with a solitary stem, and either erect or spreading in nature, depending on the situation.

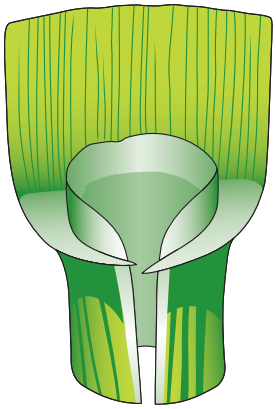
Germination may occur from the autumn right through to early spring (October-March). Flowering is relatively early, occurring between late May-August. More importantly seed is shed before cereal harvest. The seeds may become dormant and persist in the soil for periods of up to 7 years. As a result it 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 ryegrass is typically 1-2 mm long with narrow spreading auricles. Italian ryegrass spikelets on the seed head are arranged alternately along the length of the head and are awned.







Perennial ryegrass

Growth habit:
Perennial ryegrass 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 ryegrass is typically not as aggressive as Italian ryegrass early in the season.

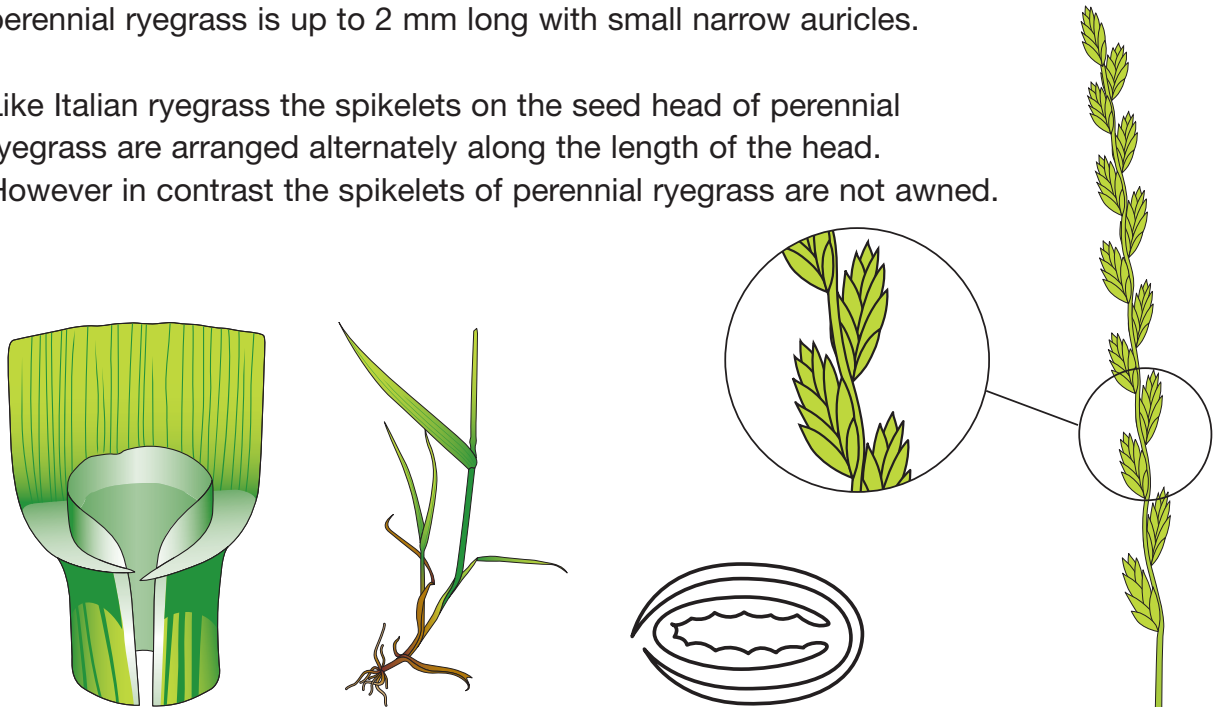
In contrast to Italian ryegrass, whilst early flowering perennials can shed seed before the cereal harvest, late flowering types may not complete their life cycle before harvest.

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

Identification:

As for Italian ryegrass, leaf blades of perennial ryegrass 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 ryegrass) 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 ryegrass is up to 2 mm long with small narrow auricles.

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



Hybrid ryegrass

Clear identification of ryegrasses is further confused by the fact that where plants of both Italian and perennial ryegrass co-exist, the two species readily hybridize. The resulting hybrids may have a combination of characteristics from both Italian and perennial ryegrass. 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 ryegrass.

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

Herbicide resistance status in ryegrass

Herbicide resistance to ACCase inhibiting herbicides (fops/dims) was first recorded in ryegrass in 1987 in Oregon, USA (7). Subsequently herbicide resistance also became apparent in the UK and, by 1999, resistance to diclofop-methyl had been confirmed in populations of Italian ryegrass on 30 farms across 12 counties. By 2002 over 100 cases of herbicide resistance in Italian ryegrass had been confirmed in 21 counties (11). Herbicide resistant Italian ryegrass is therefore now present in most areas of England. 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 ryegrass. 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) has not yet been identified in Italian ryegrass in the UK.

Herbicide resistance in perennial ryegrass occurs much less frequently than in Italian ryegrass.

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 ryegrass and anti-resistance strategies are dealt with in the following pages.

*Not approved for use in cereals.

Optimising ryegrass 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 ryegrass, 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) (11) or by HRAC (Herbicide Resistance Action Committee) (8).

Cropping and cultural control of ryegrass

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 ryegrass in the grassland phase should be avoided. Similarly, set-aside green cover ideally should not be based on Italian ryegrass.

Cultivation can be used to help manage existing infestations of ryegrass. Whilst germination of ryegrass seed occurs over an extended period, some reduction in population can be achieved by the use of stale seed beds. 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 which may be used.

Chemical control of ryegrass in cereals

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, an optimised herbicide treatment will provide the maximum level of ryegrass control.

As ryegrass can germinate over a protracted period during autumn through to the early spring, a herbicide treatment with residual activity will ensure continued effects on later emerging seedlings. However, in a situation where a high number of ryegrass 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 ryegrass control.

Active ingredients available for the control of ryegrass in cereals

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

Isoproturon (IPU) has been the mainstay of ryegrass control in the UK for many years. The chemically related active, chlorotoluron (CTU), has a reputation for more effective control of ryegrass than IPU. Whilst both actives are effective against sensitive populations under ideal conditions, they are unlikely to provide adequate levels of control in difficult situations when used alone. Both materials are active primarily via root uptake, providing residual efficacy which is of value for the control of ryegrass seeds germinating after application, when applied in association with other effective active ingredients. Additionally, as an alternative mode of action, both actives can play a significant role in an anti-resistance management strategy. Remember when using products containing IPU or CTU, always follow stewardship guidelines.

Flurtamone is another material providing residual control of ryegrasses but benefits from having a different mode of action to IPU or CTU, being a “bleacher”. Additionally, its soil mobility is lower than that of either IPU or CTU and consequently tends to remain in the rooting zone of the seedling ryegrass plants for longer.

Diclofop-methyl, tralkoxydim and pinoxaden are contact acting ACCase inhibiting herbicides which do not provide residual control. As such they will control emerged ryegrass plants but, if used alone, will not control seedlings emerging after application. However, products based on these contact acting actives typically control later stages of ryegrass than do residual products. As both diclofop-methyl and tralkoxydim belong to the “fop/dim” family of chemicals some populations of Italian ryegrass have shown resistance to them. Where resistance is suspected, the susceptibility of the population to products containing these active ingredients should be assessed before their use.

Mesosulfuron and iodosulfuron are both 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.

Chemical weed control strategies for ryegrass

The choice of products and rates depends primarily on:

- The timing of application
- The growth stage of ryegrass
- 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 ryegrass 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 ryegrass germinating after application.

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

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

Pre-emergence treatment available as part of an overall ryegrass control programme:

TREATMENT (Rate per ha)	Latest stage controlled	Notes
Liberator (0.6 L)	Pre-emergence	Use only as part of an overall ryegrass control programme

Post-emergence treatments available for the control of ryegrass up to the 2-3 leaf stage as part of an overall ryegrass control programme:

TREATMENT (Rate per ha)	Latest stage controlled	Notes
Bacara (0.5 – 1.0 L) + IPU* (2500 g)	GS12-13	-
Bacara (1.0 L) + IPU* (1500 g)	GS12-13	-
Bacara (0.5 – 1.0 L) + CTU** (up to 3500 g)	GS12-13	CTU tolerant varieties only
Ingot (3.75 L) + IPU* (up to 1000 g)	GS12-13	-
Ingot (2.0 L) + CTU** (up to 2500 g)	GS12-13	CTU tolerant varieties only
Ingot (3.75 L)	GS12-13	-

* Isoproturon – Follow Stewardship guidelines
** Chlorotoluron – Follow Stewardship guidelines

Post-emergence treatments available for the control of ryegrass up to tillering stages as part of an overall ryegrass control programme in winter wheat:
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 GS13-23

TREATMENT (Rate per ha)	Latest stage controlled	Notes
Atlantis (400 g) + Bacara (1.0 L) + biopower (1.0 L)	GS30	Apply in autumn/end of winter when there is active growth of ryegrass
Atlantis (400 g) + pendimethalin (min. 960 g) + biopower (1 L)	GS30	Apply in autumn/end of winter when there is active growth of ryegrass
Hussar (200 g)	GS30	Use only after an effective non-ALS autumn herbicide programme. Apply in early spring (after Feb 1st) when there is active growth of ryegrass
Pacifica (400 – 500 g***) + biopower (1.0 L)	GS32	Use only after an effective non-ALS autumn herbicide programme. Apply in early spring (after Feb 1st) when there is active growth of ryegrass

***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 ryegrass populations or in resistant situations:

- In situations where ryegrass 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 ryegrass control
- In known difficult ryegrass control situations always start your ryegrass control programme with a precursor herbicide treatment based on flufenacet (e.g. Liberator)
- In order to control ryegrass germinating after application, autumn treatments should typically be based on residual herbicides such as chlorotoluron, isoproturon and flurtamone (e.g. Ingot, Bacara.) However, where a high population of ryegrass plants has emerged, an autumn treatment comprising of a contact material such as mesosulfuron and iodosulfuron (e.g. Atlantis) in tank-mixture with a residual herbicide based on flurtamone or pendimethalin can provide the best option for control in winter wheat
- As the effectiveness of most ryegrass 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 ryegrass (up to GS21-23) 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 ryegrass infestations containing enhanced metabolism herbicide resistant populations will result in reduced levels of control
- Italian ryegrass 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 a precursor treatment

References

1 – National Weed Survey: 1989

2 – National Cereal Disease and Weed Survey: 1991

3 – Arable Farming, pp 20-23: April 23rd 1996

4 – The occurrence of volunteers as weeds of arable crops in Great Britain: Talbot, M. N.

5 – Weed Science 37, 350-352, Italian ryegrass (*Lolium multiflorum*) accesions tolerant to diclofop: Stranger, C.E. and Appleby, A.P. (1989)

6 – Grasses – A guide to their structure, identification, uses and distribution in the British Isles: Hubbard, C.E.

7 – The occurrence of herbicide resistant grassweeds in the UK and a new system for designating resistance in screening assays: Moss, S.R. et al

8 – Guidelines to the Management of Herbicide Resistance Herbicide Resistance Action Committee

9 – Management of ryegrass, especially herbicide resistant types: Sim, L., BCPC 37th Annual Review of Weed Control

10 – Moss, S.R., (Pers. comm.)

11 – Weed Resistance Action Group guidelines 2003: Pub. HGCA

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Ingot® contains diflufenican, flurtamone and isoproturon.
Bacara® contains diflufenican and flurtamone.
Atlantis® and Pacifica® contain mesosulfuron-methyl and iodosulfuron-methyl-sodium.
Hussar® contains iodosulfuron-methyl-sodium.
Liberator® contains flufenacet and diflufenican.

Always read the label: use pesticides safely.

August 2006

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