BASF Agricultural Solutions

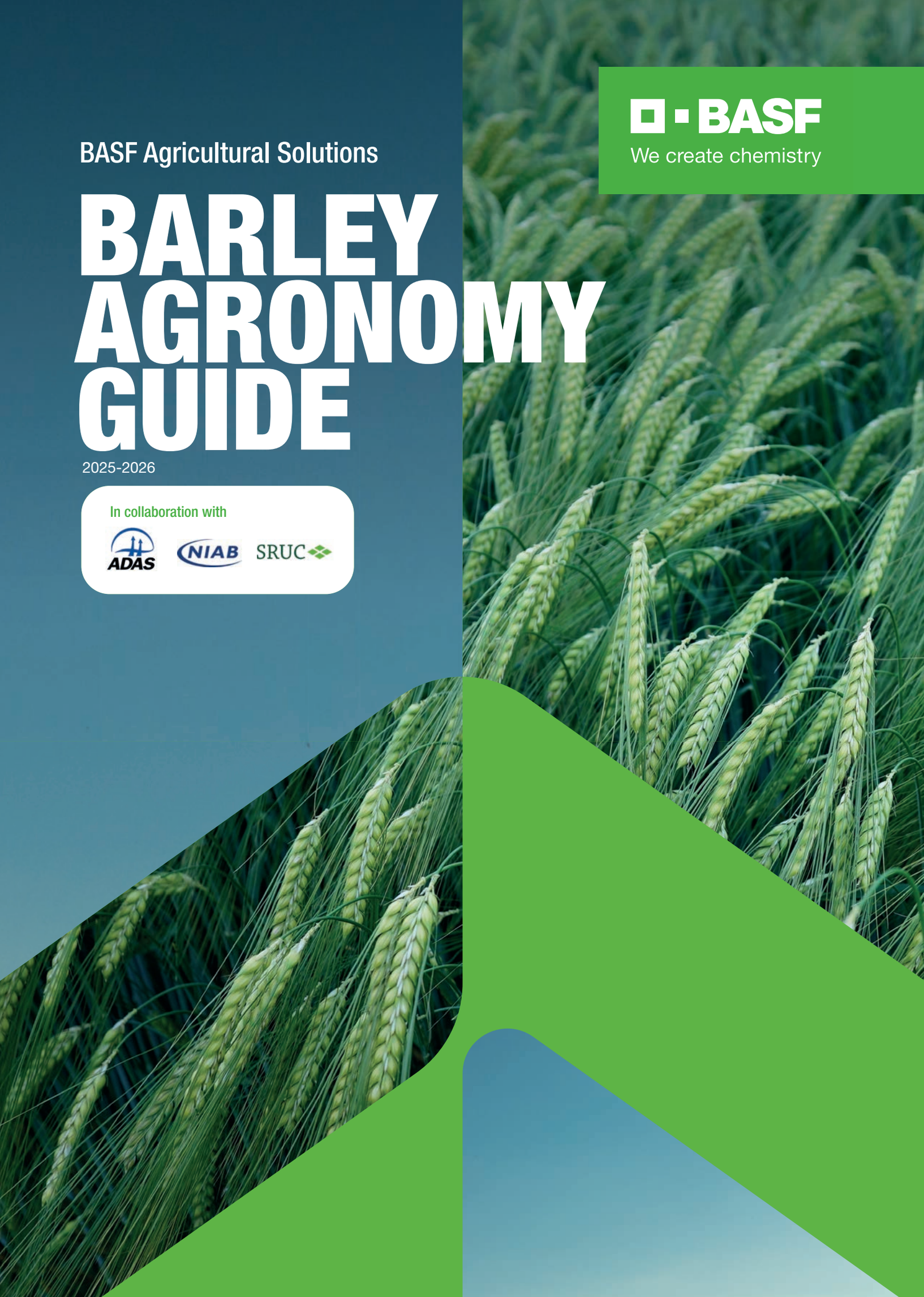
BARLEY AGRONOMY GUIDE

2025-2026

In collaboration with

ADAS NIAB SRUC

BASF
We create chemistry



WELCOME

Welcome to your comprehensive technical guide to growing barley. Within the UK and Ireland, we are very fortunate to have the ideal climate to grow some of the highest yields of barley in the world. Through collaboration with industry experts across the UK and Ireland, this comprehensive guide will endeavour to cover everything required for growing a successful crop.

We will start by discussing the key variables when it comes to creating yield potential early in crops. This means getting the basics right; where does barley sit in your rotation? What considerations should be given to variety selection, seed rates and establishment technique?

Detailed husbandry over the course of the season is a key feature to achieving high yielding crops. The consequences of BYDV and take-all infection are often misunderstood when it comes to barley. This will be covered in depth. Like any crop, balanced nutrition is vital. We will take a deep dive into fuelling a barley crop from both a macro and micro nutrition perspective.

Finally, we will delve into how to fulfil your yield potential and bring the crop home successfully. We will explore how to minimise the risks that influence lodging and brackling, a feature that has become all too common as we begin to push yield parameters even further. Disease management in barley, both early season and late season, requires a different train of thought compared to wheat. Timings and strategies will be discussed in detail within this guide.

Whether you are a seasoned agronomist or a new barley grower, this guide is designed to provide you with the knowledge and tools to successfully grow your barley crop from start to finish.

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CREATE YOUR YIELD POTENTIAL

PLAN YOUR STRATEGY

Dr Steve Hoad, SRUC

WHY BARLEY?

Barley can be a valuable addition to a farm's crop rotation, as it can be grown alongside other crops such as oilseed rape (OSR) and wheat. Winter barley is especially useful in rotations where OSR is grown, as the timing of sowing between these two crops is complementary. In recent years, there has been a growing interest in spring barley, particularly in England. This is not solely market-driven, but rather due to integrated pest management (IPM) strategies.

Growers are using spring barley as a rotational control measure where black-grass is a problem. In this case, by including spring barley in the rotation, farmers can utilise stale seedbeds and spring barley's competitive nature to manage grass weed pressure and improve overall crop yields.

MARKETS

When it comes to marketing the barley crop it is not just a case of growing a crop and then deciding where it goes. Growers need to plan according to how the crop will be marketed. Almost two thirds of Scottish barley is utilised within the drinks sector, so this really drives husbandry decisions and variety selection. Growers must ensure that their crop achieves the required specification for malting and distilling, with grain nitrogen levels or low protein levels.

In England, there is currently more interest in barley for brewing rather than the malting and distilling sectors. The brewing process typically requires a slightly higher grain nitrogen (N) level than for malting or distilling. Therefore, moderate levels of grain N or protein are preferred for brewing purposes, rather than low levels.

BARLEY CROPS MUST BE GROWN IN ACCORDANCE TO HOW THE CROP WILL BE MARKETED: FEED, BREWING, MATLING, DISTILLING.

SPRING BARLEY IS A COMPETITIVE CROP, PROVIDING GREATER COMPETITION AGAINST BLACK-GRASS.

ROTATION

Spring barley is often seen as the crop to replace winter wheat in rotations where black-grass is a particular issue. This is due to the fact that drilling is delayed until the spring, allowing opportunities to utilise stale seedbeds.

In terms of winter barley, establishing high plant populations is not only important to achieving high yields but also to compete against aggressive grass weeds. Hybrids in particular, due to their prolific tillering capacity, are especially useful in grass weed scenarios. However, care should always be taken when growing winter barley in high grass weed scenarios due to limited herbicide options available.

VARIETIES

During the evaluation process of new crop varieties, both agronomic and market evaluations are carried out in parallel. This approach involves conducting trials that are designed to evaluate the performance of the new varieties in terms of yield, disease resistance, and other agronomic traits, as well as assessing their potential market value.

AHDB looks after the agronomy side and then under the guidance of the malting barley committee, grain quality tests are done by members of the Maltsters Association of Great Britain (MAGB) who undertake micro malting tests to assess value for brewing and distilling.

Ideally growers would want a bold grain, with good specific weight and no problems with screenings or skinning, and a barley that responds to fertiliser use in a way that will deliver the grain nitrogen that the end user specifies.

The Scottish list contains varieties best suited to growing conditions and markets for Scotland and does not have the full list that might be available to UK growers. There is no formal regional list for England.

VARIETY SELECTION

Varieties have a lifespan, some last for a few years, some for longer, before being outclassed by newer varieties coming forward.

WINTER BARLEY

2-Rows

In Scotland, winter barley is mostly grown for feed use, and there are some very strong, high yielding varieties with good specific weights, which has been a really significant development of breeding.

2-Rows: KWS Tardis and **LG Caravelle** are popular feed varieties UK wide.

In England, there is a demand for winter malting barley varieties, and two varieties that are currently favoured are **Craft** and **Electrum.**

In recent years the winter malting sector has been seeking value in much older varieties, with **Pearl** and **Maris Otter** still being used.

6-Rows

At the moment, on the AHDB Recommended List, the 6-row varieties are dominated by modern hybrids, which bring with them the capacity to achieve **high yields** with improved **specific weights.** As these are grown for feed, these are desirable characteristics to have, however, because they do produce bumper yields, they can have a slightly higher lodging and brackling risk.

> **“DEFRA STATISTICS SHOW AN AVERAGE INCREASE OF 91% IN THE AREA OF ENGLISH SPRING BARLEY OVER THE LAST 10 YEARS.”**
>
> 2013-2023, compared to the base year 2000.

SPRING BARLEY

Spring barley in Scotland and England is dominated by **Laureate,** which can suit malt, distilling and a range of different brewing needs. This variety accounts for approximately two thirds of the intake in both England and Scotland.

In Scotland, with the emphasis on **distilling,** varieties like **LG Diabolo, Firefox** and **KWS Sassy** are relatively important as they are suitable for distilling only.

In England, where **brewing** is more prominent, **RGT Planet** and more recently **Skyway** are key varieties.

NEW VARIETIES

In 2024, new spring barley varieties **SY Tennyson** and **Diviner** were in year two of the AHDB Recommended List and the Scottish list trials. In November 2024, SY Tennyson was granted full approval from the malting barley commission.

SY Tennyson is suitable for both brewing and distilling whilst **Diviner** is for malt distilling only.

Even with SY Tennyson gaining full approval in 2024, it can take four or five years to gain confidence in a variety, and that must then be tied in with seed becoming available for it to lift off and begin to take market share.

In 2025, three new winter barley varieties have been added to the RL list, with nine varieties removed. The new varieties are Darcie and Catapult two row feed varieties and Barnabus a new six-row hybrid.

In spring barley there are four new varieties, with three under evaluation for both brewing and malt distilling. The varieties are: **Trailblazer, Roulette, Shona and Nolan**.

GIVE IT THE BEST START

Will Vaughan-France, NIAB & Ciaran Collins, Teagasc

Barley yield is sink limited, which means the yield is limited by the number and capacity of grain sites. Creating yield potential in winter or spring barley is about maximising sink strength, which means establishing the crop in a way that enables the crop to strongly develop and tiller.

Spring barley has a shorter growing season and less time to build its sink capacity. Therefore, good establishment is required to enable rapid development and formation of tillers.

Creating Yield

Protecting Yield

SEED

CERTIFIED

Certified seed gives growers the assurance of varietal purity and traceability, alongside acceptable germination rates and disease levels.

HOME-SAVED

The key point to note with home-saved seed is that the parent crop has been managed with the intention of being grown to produce seed. Although some seed dressings have an impact on loose smut, we must ensure the seed crop is free of loose smut, when it comes to managing carryover in seed.

Loose Smut in barley

Home-saved seed must be:

1. **Free of weeds** - Especially Wild-oats and grass weeds like black-grass and Brome.
2. **Clean of disease** and tested for loose smut and leaf stripe before use.
3. **Harvested in good conditions.**
4. **Dried, cooled and stored carefully.**
5. **Tested for germination and thousand grain weight (TGW) measured.**

In Ireland, using home-saved seed is not common, with most growers preferring to sow seed certified by the Department of Agriculture Food and Marine (DAFM).

SEED TREATMENT

Germination and relevant diseases should be checked before deciding if seed is to be treated or not. However, first and foremost, care must be taken when sampling to ensure a fair representation of the crop.

Seed treatments can be effective on loose smut, seedling blight, foot rot, leaf strip and snow rot.

DRILLING DATES

COUNTRY	WINTER BARLEY	SPRING BARLEY
UK	Mid-September - Late October	February - April In the south, some areas sown from November onwards.
Ireland	Late September - Late October	Early March – late April

GOOD ESTABLISHMENT IS REQUIRED TO ENABLE RAPID DEVELOPMENT AND FORMATION OF TILLERS.

PLANT POPULATIONS

Growers need to consider their soil type and what sort of establishment level that soil will give; a free draining warm soil, is very different from a cold, wet, waterlogged soil.

UK - WINTER BARLEY

With a conventional variety, growers should be aiming for **800-1000 ears/m^2.**

IRELAND- WINTER BARLEY

With a conventional variety, growers should be aiming for **~950-1000 ears/m^2.**

TARGET PLANT POPULATIONS AND % ESTABLISHMENT FOR 2-ROW WINTER BARLEY **(IRELAND)**

SOWING DATE (WEEK)	SEPT (4TH)	OCT (1ST)	OCT (2ND)	OCT (3RD)	OCT (4TH)
TARGET PLANTS/M^2	270	280	290	300	310
% ESTABLISHMENT	85	85	85	80	75

HYBRID BARLEY

In both Ireland and the UK, hybrid winter barley seed is sown in packs to cover **5 ha,** which equates to a seed rate of **200 seeds/m^2.** This is the recommended rate where conditions are good.

UK - SPRING BARLEY

Because there is such a range of drilling dates for spring barley, potentially across six months, there are quite a range of optimal plant populations. With early sowing, growers would ideally want to achieve **250 plants/m^2, increasing to 350 plants/m^2** as the drilling period nears its end in **April.** The final aim is to achieve 800-1000 ears/m^2 from these plant populations.

IRELAND - SPRING BARLEY

The sowing window for spring barley is much shorter in Ireland than in the UK. With this in mind, Irish growers are aiming to establish between 280-325 plants/m^2 (see table below).

TARGET PLANT POPULATIONS AND % ESTABLISHMENT FOR SPRING FEED BARLEY **(IRELAND)**

SOWING DATE (WEEK)	UP TO MID-MARCH	MID TO LATE MARCH	EARLY TO MID-APRIL	LATE APRIL
TARGET PLANTS/M^2	280	300	300	325
% ESTABLISHMENT	85	85	85	90

Target plant populations and % establishment are similar for spring malting barley.

SUMMARY

David Leahy - BASF

Winter Barley UK
Typically aim for 800+ ears/m^2

Winter Barley IE
Drill 270-310 plants/m^2 to achieve 800-1,000 ears/m^2

Spring Barley UK
Drill 250-300 plants/m^2 to achieve 800+ ears/m^2

Spring Barley IE
Drill 280-325 plants/m^2 to achieve 800-1,000 ears/m^2

David Leahy from BASF explains why we have different seed rates in the UK and IE...

> **"Even though established plants/m^2 differ slightly between the UK and Ireland, both are aiming to achieve 800-1,000 ears/m^2. With barley being sink limited, achieving a high number of grains/m^2 is one of the most important factors associated with achieving high yields.**
>
> **A wider drilling window in the UK, both for winter barley and spring barley lends itself to reduced seed rates earlier in the season, increasing as the season progresses."**

SEED RATE

Seed rates vary with the sowing conditions, which are more important than the actual drilling date because of the effect on % establishment.

Calculating seed rate:
EXAMPLE

$$\frac{\textbf{Target plant population (m}^2\textbf{) X thousand grain weight (g)}}{\text{\% establishment}}$$

$$\frac{\textbf{280(plants/m}^2\textbf{) x 53 (TGW) = 175kg/Ha}}{85\%}$$

> **IF ROLLING AFTER DRILLING LOOKS UNLIKELY, GROWERS SHOULD CONSIDER CONSOLIDATING SEEDBEDS BEFORE DRILLING TO HELP WITH ESTABLISHMENT.**

ESTABLISHMENT TECHNIQUES

Establishing crops efficiently and effectively is crucial, especially for spring barley. It is essential to choose a system that ensures rapid and high-quality crop establishment, while also leaving the land capable of withstanding changing weather conditions. Generally, in the UK and Ireland, most barley is established either with plough based or some sort of min till or strip till system.

Ensuring good seed to soil contact is critical to establishing strong crops of barley. Typically speaking, growers could drill spring barley earlier if ploughing compared to low disturbance systems.

This is because the ground is slower to warm up in low disturbance systems. It is the reverse for winter barley, where growers will drill earlier compared to plough-based systems, as crops will be slightly slower coming through.

In general, growers practicing low disturbance systems of establishment should drill winter barley earlier and spring barley later compared to plough-based systems.

ROLLING

It is ideal to have drilling conditions that allow for rolling, but the reality is that this may not always be possible. Rolling should be carried out on dry or drying soils, especially when moisture conservation is a concern, or when there is a risk of slug infestation. Additionally, rolling is beneficial in achieving a uniform seedbed for the effective application of pre-emergence herbicides.

However, if the conditions are such that there is a risk of compaction, capping, or ponding, it is not recommended to roll the soil.

PROS AND CONS OF BARLEY ESTABLISHMENT SYSTEMS

SYSTEM	PROS	CONS
Plough based	• Relatively flexible in terms of drilling date and soil conditions • Reliable establishment • Allows burial of problem weeds	• Labour, time and cost intensive • Moisture may be lost in a dry autumn or spring
Min till and Strip till	• Covers large areas quickly • Enables rapid establishment • Labour and cost savings • Winter barley can be drilled earlier in the season if conditions allow	• Grass weed* and volunteer populations can increase; Brome and volunteer wheat can be a particular problem in winter barley • Increased risk of trash borne diseases • Winter barley cannot be drilled as late in the season • Spring barley drilling needs to be delayed until soil conditions allow and soil temperatures rise
Direct drill	• Covers large areas quickly • Least cost intensive • Winter barley can be drilled earlier in the season if conditions allow • Direct drilling or where large amounts of straw have been incorporated could possibly benefit from Autumn N application	• Soils must be in really good condition • Grass weed and volunteer populations can increase; Brome and volunteer wheat can be a particular problem in winter barley • Increased risk of trash borne diseases • Winter barley cannot be drilled as late in the season • Spring barley drilling needs to be delayed until soil conditions allow and soil temperatures rise

*Good grass weed control can be difficult to achieve in winter barley, due to fewer herbicide options available. Options are limited to pre-emergence or early post-emergence.

MINIMISE RISK FROM THE OUTSET

TAKE-ALL

Jonathan Blake, ADAS

Lifecycle

Take-all infects cereal crops the first year they are grown but is generally at non yield damaging levels. Take-all generally effects yield where susceptible crops are grown for two or more years in a row.

Winter barley, in UK and Irish rotations, tends to be grown in the second 'slot', often after first wheats. This second cereal situation tends to be where take-all pressure is highest. Barley is often sown in this rotational position as it is more tolerant of take-all than wheat

Spring barley can be affected by take-all levels, when sown after a susceptible crop. Although levels will decline between the first cereal and the second, because there is a bigger gap between the harvest of one and the sowing of the next, this is counterbalanced by spring barley rooting less extensively. So, although take-all is at lower levels than in a winter crop, it can have a similarly significant effect.

TAKE-ALL DECLINE

The second or third cereal would be worst affected in a rotation, however, as you carry on growing cereals take-all decline comes into play, whereby antagonistic microflora that affect the take-all pathogen increase and the impact of take-all on yield declines.

SYMPTOMS AND LOSSES

Plants affected by take-all show black roots and black lesions on stem bases. The disease can occur in patches and leads to stunted plant growth, uneven ripening, and white heads.

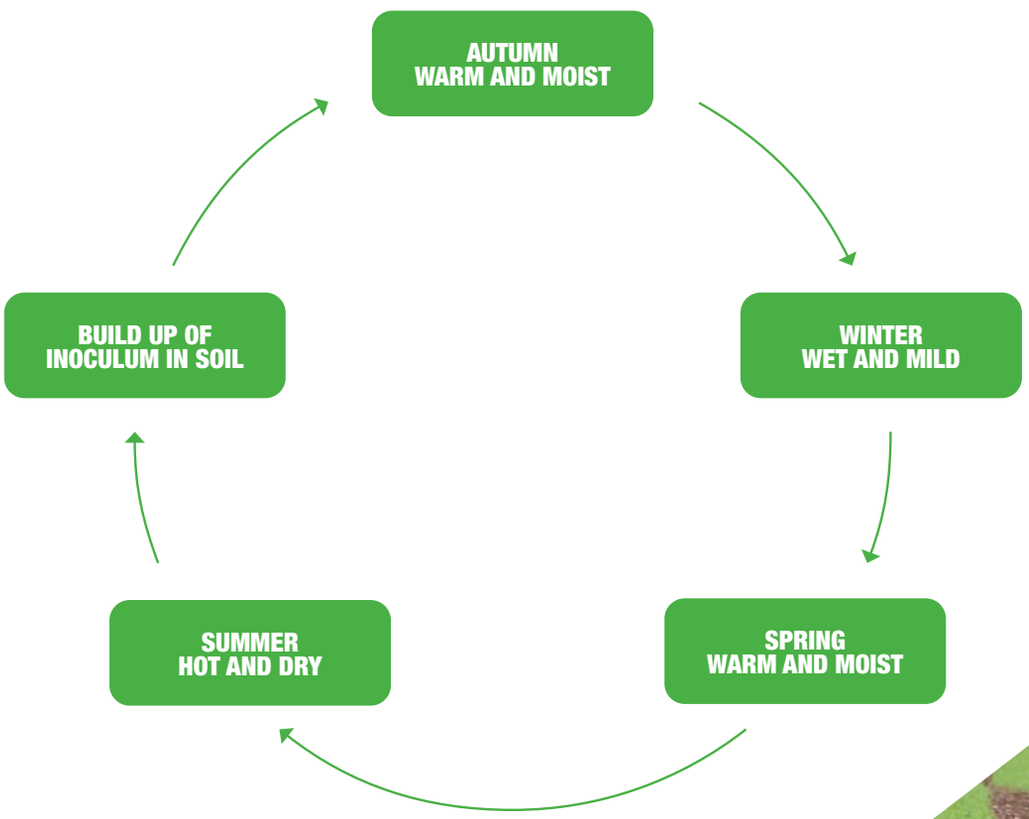
Yield losses are less in barley than in wheat. In wheat, second wheats usually average around 1.0 t/ha less than first wheats, with the majority of this being attributable to take-all.

In barley, yield differences due to rotational position usually range from no effect up to 0.5 t/ha.

FACTORS AFFECTING SEVERITY

The degree of yield loss due to take-all is severely impacted by weather factors. Rainfall is the key parameter: A wet and mild winter, followed by a dry late spring and summer, is where the biggest effects of the disease are seen. Wet winters, will limit root growth and allow the take-all pathogen to spread. A dry late spring will potentially have a dire effect on barley as the restricted rooting will prevent adequate water and nutrient uptake.

HIGH RISK CLIMATIC CONDITIONS			
AUTUMN WARM MOIST	WINTER MILD	SPRING WARM MOIST	SUMMER HOT AND DRY



CULTURAL CONTROL

Varietal tolerance and chemical options for take-all are limited, so reducing the severity and impact is largely dependent on cultural control approaches.

EXTENDING THE ROTATION

This is the most effective way to manage take-all. The longer the period prior to planting of barley, where a non take-all host crop has been grown, the less take-all you will have in that first barley crop.

Two or three years of non take-all host crop will result in very low levels of take-all in that first cereal and low levels in the second cereal as well.

Growing barley in first cereal situations can be a win win situation. This will reduce take-all and lead to higher yields. In crops grown for malting, this can be significant as higher yields will dilute grain nitrogen, a key parameter for this crop.

AVOID A GREEN BRIDGE

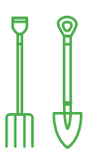
This management strategy plays a role in reducing take-all in successive cereal crops. The use of stale seedbeds will help mitigate this risk. Also, the control of cereal volunteers in break crops can reduce carry over into subsequent cereals.

SOWING DATE

Two aspects need to be considered: the sowing date of the current crop being sown and that of the previous crop as both will affect the severity of take-all. The earlier the previous crop (first cereal) was sown the more primary infection there would have been in that crop, and so the more infection will be carried over into the crop being sown (second cereal).

Remember the optimum sowing date for winter barley would be the last week of September or the first week of October to allow crops to get established and reduce the risk of plant loss through the winter. So, there's a trade-off between trying to establish good, well tillered barley crops, and the take-all pathogen which will have a negative effect.

GETTING CROPS WELL ESTABLISHED



SOILS

Take-all is affected by soil type and risk can vary within a soil series. Light soils – either because they are better suited to the pathogen or that they are more likely to suffer from drought effects that take-all can cause, tend to be most affected by take-all. Ensure soil pH is appropriate to the barley crop so that it can grow effectively. Be careful of applying lime in the same autumn as winter barley is being drilled into a take-all slot. High levels of lime in this situation can actuate take-all.

NITROGEN, PHOSPHORUS AND POTASH

Nitrogen should be applied earlier to crops in a take-all risk situation than to crops sown in "first slots". Applying nitrogen early encourages early growth so plant roots can explore the soil more effectively, which will reduce the impact of take-all as will ensuring indices of phosphorus and potash are conducive to good early growth. Greater soil fertility tends to reduce the impact of take-all.

ESTABLISHMENT METHODS

There is no evidence that different cultivation methods have an impact on take-all. Well-structured soils tend to encourage root growth and reduce the impact of take-all. Compacted soils reduce root growth so can increase yield loss due to take-all.

CHEMICAL

SEED TREATMENT

Silthiofam is active on take-all when applied to winter barley, but its yield impact is less clear cut. Historically, yield responses to silthiofam have been variable in barley, early AHDB work indicated little or no yield response, however, some more recent commercial trials have shown average benefits of around 0.25 t/ha. Early sown crops would be where you would think to put seed treatments on as they would have the highest yield potential so more likely to have a higher sink size.

REDUCING THE IMPACT OF TAKE-ALL: KEY POINTS

1. Plan a long-term sustainable rotation.
2. Be aware of previous year's climatic conditions when assessing risk.
3. Ensure that pH, P, K and Mn levels are adequate.
4. Control volunteers and grass weeds in break crops. Avoid a green bridge between successive cereals crops.
5. Consider the use of silthiofam seed treatments in situations where take-all is likely. This will not fully control take-all but will help, especially if used as part of an integrated approach.
6. Avoid very early drilling dates for winter crops if a second cereal is planned the following year.
7. Apply nitrogen earlier to crops where the risk of take-all is high.

BARLEY YELLOW DWARF VIRUS

Dr Sacha White, ADAS

Barley Yellow Dwarf Virus (BYDV) has become an issue in recent years because control has changed dramatically with the demise of neonicotinoid seed treatments. Chemical control now relies on applications of foliar pyrethroids. However, moderate levels of resistance are widespread in the UK and Ireland in **grain aphid**, one of the two main vectors of the disease. Mitigation of this disease also relies heavily on cultural control methods. Both winter and spring barley crops are affected and the earlier the crop is infected with BYDV the greater the yield impact tends to be. Little yield loss is suffered if infection occurs after GS31. Spring crops tend to quickly reach GS31 and as aphid migration typically starts around April, generally there is less BYDV in earlier drilled spring barley.

TRANSMISSION

In earlier drilled spring barley, BYDV is transmitted by three species of aphid in the UK and Ireland. All transmit BYDV in spring crops, but **grain aphid, bird cherry-oat aphid** and **rose grain aphid** are the main vectors in winter crops. Aphids initially introduce the virus to a small number of plants (primary infection), before spreading the virus to neighbouring plants as the aphid population grows, infecting them throughout winter (secondary spread). This leads to patches of infection.

SYMPTOMS AND LOSSES

In winter crops, symptoms tend to appear from April onwards as discoloured and/or stunted patches. Leaves turn a striking chrome yellow colour with discolouration starting at the leaf tips and margins before progressing across the leaf.

The virus affects the plant in a variety of ways, reducing:

- Root development
- Plant height
- Grains/m^2
- Tillers/plant
- Grains/ear
- Thousand grain weight (TGW)

SEVERE YIELD LOSSES FROM BYDV ARE UNCOMMON, BUT CAN BE UP TO 80% IN WINTER BARLEY

MINIMISING THE RISKS OF BYDV

There are several ways in which growers can predict and monitor when aphids are likely to arrive in crops.

T-sum Calculator – predictive model

This day degree model predicts the appearance of the 2nd generation of wingless aphids in the crop, which are associated with the start of secondary spread. Crops are thought to be at an unacceptable risk when 170 day degrees above a baseline of 3˚C have accumulated. At that point growers should check their crops for the presence of aphids and consider treating.
The model should be started at crop emergence or following a pyrethroid application (account for product persistence by checking the label).

AHDB T Sum-calculator
www.ahdb.org.uk/bydv

Rothamsted Insect Survey
www.rothamsted.ac.uk/national-capability/the-insect-survey

Monitoring

- Growers should monitor crops visually from the point of crop emergence through to the end of aphid migration, usually in December. Growers should choose warm, sunny days, not after frost or rain and check the base of each plant.
- Monitoring using water traps is likely to be more effective in detecting aphid presence than plant monitoring. Use a minimum of one trap per field. Place the trap within 20 m of a field margin and near hedges or woods, if present, as aphids tend to enter the crop from these areas. Check and reset weekly.
- The Rothamsted Insect Survey produces weekly data on aphid numbers caught in suction traps. Use this to monitor the timing of the aphid migration, and to inform in-field monitoring efforts. This is available free, via text alerts.

EFFECT OF WEATHER

Temperature affects both the primary infection (the aphid migration) and the secondary spread of the infection (when aphids move to neighbouring plants).

If temperatures are mild in the autumn and winter, then the migration period can extend and the rate at which the secondary spread takes place can increase. Climate change bringing milder autumn and winter weather patterns are likely to increase BYDV pressure.

CULTURAL CONTROL AND MANAGEMENT STRATEGIES

FIELD EFFECTS

Fields within 10 km of the sea and with permanent grassland within the vicinity are more prone to BYDV.

BYDV TOLERANT VARIETIES

There are several commercially available varieties, which reduce the need for insecticides and give growers security in high risk areas.

DELAYING DRILLING

- For winter barley, delaying drilling is the most important factor determining BYDV risk and the most reliable cultural control that growers can implement to manage their risk.
- Delaying drilling significantly reduces the risk of BYDV infection and yield loss due to temperatures declining as we progress through autumn and winter.
- However, later drilled crops of spring barley are more susceptible to BYDV, due to the fact temperatures are increasing.

ESTABLISHMENT TECHNIQUE

Results from several trials suggest that minimising tillage reduces aphid numbers and BYDV infection compared to conventional tillage.

- Minimising tillage may conserve more aphid natural enemies (e.g. ground beetles and parasitoids).
- A minimum tillage approach lessens the contrast of the green foliage against the dark soil, which these aphids may use as a visual cue when migrating.

APHIDS' NATURAL ENEMIES

Rationalise insecticide use, reduce cultivations and modify habitats to enhance, encourage and support their activity.

AVOID A GREEN BRIDGE

Destroy weeds at least 5 weeks in advance of drilling, especially annual meadow grass and volunteers. Where glyphosate is used as part of a sterile seedbed approach, ensure weeds dying from the herbicide application do not coincide with the emerging crop as this encourages aphids to rapidly move over to the new crop. If a green bridge is present, then carefully monitor the crop and the green bridge before and after emergence; consider spraying if wingless vectors are present.

CHEMICAL CONTROL

Currently the only chemical control option growers have is foliar applications of pyrethroids. Pyrethroid resistance in grain aphid is widespread in the UK and Ireland, however, this resistance is moderate meaning a full rate of a pyrethroid should still provide control. As there are no thresholds, a spray should be considered if aphids are found.

To minimise pyrethroid applications, use decision support systems (DSS) such as the T-sum tool to help time sprays. The overuse of pyrethroids poses a stronger pressure for other forms of resistance to develop.


AXION

KEEP IT HEALTHY

DEALING WITH WEEDS

John Cussans, ADAS

Winter and spring barley can be robust, aggressive, suppressive crops and growers are able to take advantage of this competitiveness to help deal with weeds.

The term crop suppression means that the seed return from every single weed that survives the herbicide is reduced, not that the numbers of weeds that germinate are reduced.

WINTER BARLEY

In terms of dealing with weeds, the advantage of having winter barley in the rotation lies in harnessing the competitiveness of the crop. This crop competition can give a reduction of up to 70% in the seed return compared to a vigorous wheat crop. NIAB research has found that botanical 6-rows are more suppressive than 2-rows at the same plant density.

SPRING BARLEY

Spring barley gives two cultural control methods stacked: spring establishment and crop competitiveness. A spring crop in the rotation will give an approximately 90% reduction in black-grass plants emerging in the sown crop compared to a winter sown cereal. In addition, spring barley is more competitive than spring wheat.

INTEGRATED PEST MANAGEMENT

As with weed management in other crops, IPM should be used before thinking of herbicide strategies.

Know your weeds

If winter or spring barley has been adopted to combat black-grass and growers notice an increase in other weed species, they need to understand that this can also be driven by the adoption of these crops. In winter barley the inability to make use of the ALS family of herbicides can lead to an increase in Wild-oats and Bromes in particular. The key driver of weeds in spring barley is establishment timing; winter germinating weeds like black-grass are reduced but spring germinating weeds like common Wild-oat, Bindweed, Fat Hen are encouraged.

In terms of yield penalty, broad leaved weeds are not as much of an issue because of crop competition and available chemistry; cleavers are the exception.

Keep records

Identify the weeds, where they are and note how populations change over time.

Problem weeds

In terms of the most competitive weeds, it is the same in barley as in wheat:

- Italian Ryegrass
- Wild-oats
- Cleavers

Individual black-grass plants are not terribly competitive; the issue is the population build up.

Growth stage

Understand the growth stage of the targeted weeds, targeting as small a growth stage as possible.
For soil acting residuals, herbicides should be applied as soon as possible after crop drilling. This is the optimum strategy and applications should be prioritised before any indication of weed or crop emergence. For broad leaved weeds, most families of contact herbicides do need the weed to be growing actively for optimum efficacy.

Soil health

Good soil health is key for competitive growth of all crops.

Generally, growers should:

- Maximise the number of days of the year with ground cover.
- Reduce cultivation intensity and frequency.
- Diversify the plants in the soil, both in space and time.

Strategic ploughing

Used as a tool to reset the weed management situation.

Evidence shows strategic ploughing, when conditions are right to get good inversion, does not undermine soil health improvement achieved by adoption of reduced cultivation alongside cover and/or companion crops; soil health improvement is not reset by a single use of ploughing.
It does take the soil health back a step, but it does not take the soil back to square one. Using ploughing strategically to reset weed management helps make the system sustainable.

Photo of black-grass in wheat

Stubble Managment

Barley is taken off slightly earlier than other crops giving an opportunity to maximise stubble management losses post-harvest. NIAB now encourage growers to decide whether they are going to **either** maximise the losses of seeds from the soil surfaces, through natural processes **OR** maximise the losses by intervening and doing some cultivation.

Data shows that both sets of losses cannot be promoted simultaneously but both approaches work most effectively in different seasons and growers should adapt their strategy accordingly.

If conditions are very dry through and post-harvest:
- Take off as much straw as possible
- Leave the weed seeds to losses on the surface

If there is good soil moisture, carry out a very shallow minimal cultivation post harvest to:
- Incorporate straw
- Increase seed to soil contact
- Promote seed germination of volunteers and weeds

Stale seedbeds

A mainstay of grass weed management.
- Cultivations should not be below 5 cm
- In most seasons it takes 3-4 weeks to see the effects of this technique in full weed seedling germination, meaning that a stale seedbed where the crop is drilled too quickly after cultivation can be counterproductive.

Delayed drilling

- Maximises the gap between harvest and drilling, increasing the period where all grass weeds e.g. black-grass, Italian Ryegrass, Bromes, Wild-oats and some broad leaved weed seeds are vulnerable to either direct loss of viability or lethal germination.
- Delayed drilling also maximises the effect of pre-em herbicides as the likelihood of soil moisture is increased, resulting in some years, in an increase of 2 or 3 times the herbicides efficacy.

These two drivers of the effectiveness of delayed drilling work together to make this a robust cultural control approach for all grass weeds.

Fallow/grass

The ultimate weed control strategy in the rotation. Periods in a rotation where weeds are not encouraged to germinate and are prevented from setting seed.

- If growers are seeking a grass weed management solution, they need to ensure any subsidy schemes they sign up to have options available to do achieve those things.

Rogueing

- Important part of ongoing management if the population of grass weeds is at a really low level, or there is a zero-tolerance approach, whatever the species.
- Maintaining the population at a relatively low level is easier than getting to a high point and try to claw it back.

Crop Destruction

- Spraying out patches with a glyphosate product, where a weed population is too high to realistically rogue is going to pay dividends in the long run, from a weed management perspective.
- Focus on the highest density areas if distribution is patchy.

“DELAYING DRILLING MAXIMISES THE GAP BETWEEN HARVEST AND DRILLING, INCREASING THE PERIOD WHERE ALL GRASS WEEDS AND SOME BROAD LEAVED WEEDS ARE VULNERABLE TO EITHER DIRECT LOSS OF VIABILITY OR LETHAL GERMINATION.”

HERBICIDES

In order to control weeds, early removal is crucial, allowing the crop to get off to the best possible start, gaining the competitive advantage.

PRINCIPLES OF PRE-EMERGENCE APPLICATIONS

1. Apply pre-ems within 48 hours of drilling.
2. Pre-ems work better where there is soil moisture than where the conditions are really dry.
3. Delaying until dry seedbeds get moisture has not been seen to improve weed kill in trials.
4. Moderate the pre-em input if there are downpours forecast after drilling.
5. Adapt to the season, e.g., if growers have high grass weed pressure and it is very very dry, do not drill.

KEY RISKS

- Not getting the seed in deep enough.
- With disc type drills that form slots in dry conditions the seed can be exposed. If there is rainfall, the herbicide can move down into the crop germination zone.

There are fewer herbicides in the growers' barley crop armoury when tackling grassweeds like Wild-oats and Brome, e.g. ALS grass weed herbicides cannot be used in barley.

RESISTANCE

If growers are getting less herbicide control of weeds than they have in the past, it is probably time to start herbicide resistance testing but it's important to carry out resistance testing in a considered and methodical way. Herbicide resistance is a phenomenon that develops on a field scale so testing needs to be done systematically on a field-by-field basis over time.

WITH ALL HERBICIDES

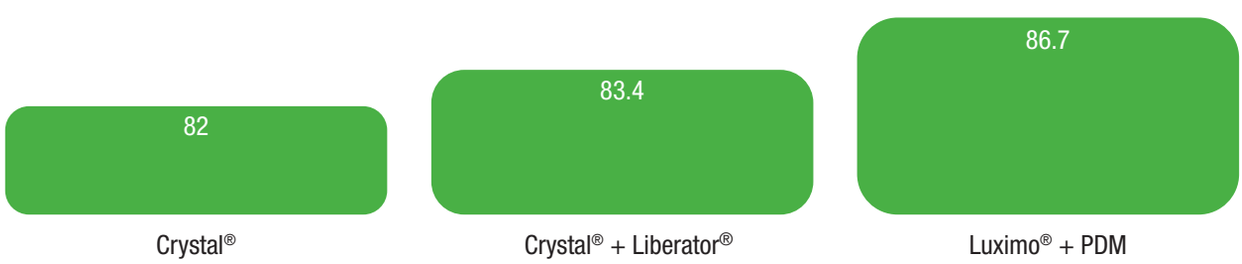
- **Read the label.**
- **Understand the growth stage of the weed targeted as there is less efficacy when weeds are tillering or beyond rosette stage.**

LUXINUM® PLUS USE IN SPRING BARLEY

BASF

- Use full label dose of 0.7 l/ha to control black-grass or ryegrass.
- Apply pre-emergence for best efficacy.
- Pack partners must still be used eg pendimethalin or picolinafen.
- Luxinum® plus should not be applied to winter barley.

PRE-EM % BLACK-GRASS CONTROL IN SPRING BARLEY 2020 – 2022 (N=8), MEAN UNTREATED = 29 HEADS/M²



The superior grassweed control from Luxinum® Plus applied pre-emergence is the best way of getting on top of any grass weed problems and ensuring your spring barley gets off to the best start.

KEEP IT HEALTHY

FUEL YOUR CROP

Dr Sarah Kendall, ADAS

PH

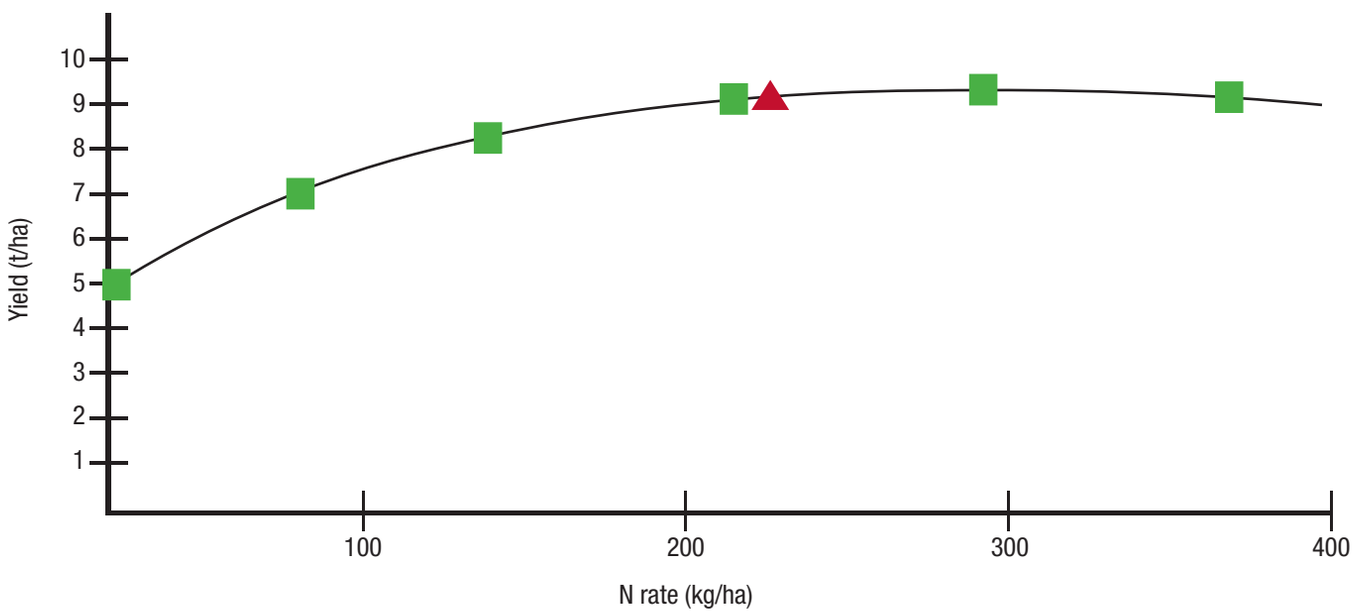
Soil pH usually ranges from about 4 (very acidic), when most crops fail, to about 8. With the optimum pH for arable cropping being 6.5. Barley prefers a slightly higher pH of between pH 6.5-7.0.

Macronutrients Nitrogen (N) Phosphate (P) and Potash (K)

NITROGEN (N)

- Critical for tiller production and retention, along with canopy formation.
- Fundamental nutrient in achieving yield potential.

Figure 2 Typical N response curve for winter barley. Red triangle indicates the economic optimum N rate for a BER of 5:1.



N DEFICIENCY SYMPTOMS

- Loss of vigour.
- Small pale green or yellowish leaves with symptoms first appearing on old leaves.

Image courtesy of YARA

“ALL N SHOULD BE APPLIED BY GS32 ON WINTER BARLEY CROPS ”

WINTER BARLEY - TIMING OF N APPLICATION.

Autumn application - In RB209 there is no recommendation for autumn N and the SRUC Technical note generally advises against autumn N, as profitable responses are generally not achieved and applications of N in the autumn could result in leaching into watercourses.

Spring application - Where the nitrogen requirement is…

- **Less than 100 kg N/ha**, apply this amount as a single dressing by early stem extension (GS30–31).
- **Between 100 and 200 kg N/ha**, split the dressing with half during late tillering in mid-February/early March and half at GS30–31.
- **200 kg N/ha or more**, apply three splits with 40% during late tillering in mid-February/early March, 40% at GS30 and 20% at GS31/32.

SPRING BARLEY - TIMING OF N APPLICATION.

Spring barley has a relatively short growing season and needs to establish rapidly.

- Apply all nitrogen between the time of drilling and GS30, with at least 40 kg N/ha in the seedbed.
- If the crop is sown before March, or on a light sand soil, or if there is a likelihood of substantial rainfall soon after drilling, then limit any seedbed N applications of more than 40 kg N/ha to reduce the risk of nitrate leaching.

Nitrogen applications taking account of the end market- Low N malting

- A reduction in N rate of 30 kg/ha has been shown to decrease grain N% on average by 0.1% across a wide range of grain N contents (1.5% to 1.9%)
- Changes in the timing of N application between seedbed and GS30 have little effect on grain N%
- Grain N may be diluted in high-yielding crops
- Where quality premiums are expected to be low, the use of a slightly higher nitrogen rate will maximise the yield potential of the crop
- For both winter barley and spring barley, measuring grain N% can be a useful indicator to ensure both N rates and N timings are optimal.

EARLY NITROGEN IS KEY TO ENSURING SUFFICIENT TILLERS ARE PRODUCED AND RETAINED IN ORDER TO FULFIL YIELD POTENTIAL.

IMPORTANT REGULATORY UPDATE UREA APPLICATIONS

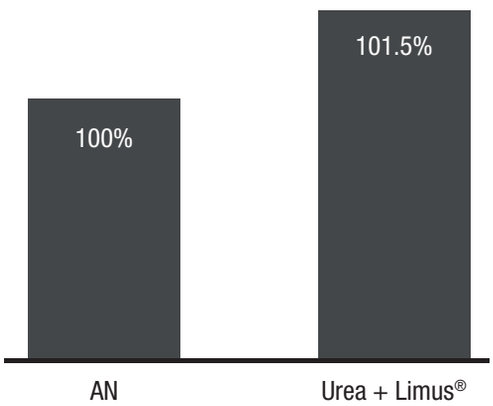
From April 2024, under the new policy 'option 4', England's urea applications must be applied with an inhibitor to reduce ammonia emissions.

UREA RULE CHANGES AS PART OF THE UK GOVERNMENT'S CLEAN AIR STRATEGY

- In England, from 1st April 2024 (and each subsequent year) applications of all urea containing fertilisers will need to include a urease inhibitor.
- Applications of untreated urea and UAN liquid fertiliser will then only be allowed between 15th January & 31st March each year.
- Audits for compliance on farm will occur from 2024 onwards.

BASF's Andrew Clune stresses the programme is not legislation, "It's a new stewardship programme to curb ammonia emissions from urea fertilisers. Similar to the Voluntary Initiative, if the industry can lead the way to cleaning up emissions, it will help prevent future interventions such as legislation. It's also providing an opportunity to capitalise on the carbon footprint and economic benefits of urea fertiliser, as Limus protected urea can deliver the same yield as AN. In trials we have seen Limus® increases nitrogen recovery and NUE leading to an additional 5% yield over untreated urea".

Relative yield increase (%) of Limus® vs AN



SOURCE: ADAS/BASF, UK winter wheat, n=6, 260 kg/ha N in 3 applications

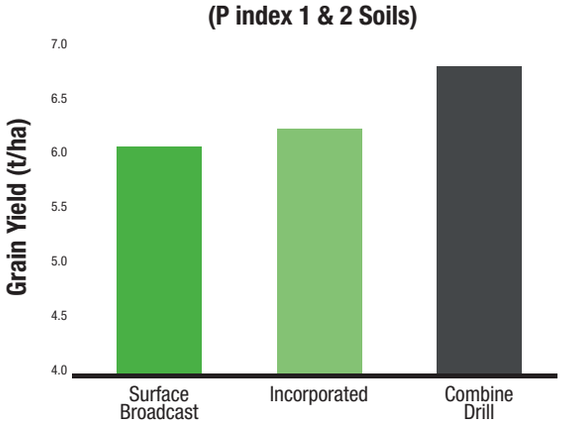
PHOSPHORUS (P)

As well as a suitable pH, barley growth is reliant on adequate supplies of P and K. With the role these macronutrients play in plant processes, these are generally considered earlier in the season than nitrogen.

- Early P is important for root and tiller development.
- Any reduction in rooting impacts uptake of other nutrients and a loss of tillers can reduce yield potential.
- It is crucial to measure soil reserves regularly and replace offtakes. P is relatively immobile in the soil.

Method of application - In spring barley, there is a benefit from placing P with the seed but there is generally no benefit for winter barley, unless soil P indices are very low.

Grain Yield Response to Phosphorus (P index 1 & 2 Soils)



Phosphorus Application Method (20 kg/ha P)

Source: Teagasc Spring Barley Guide 2015.
www.teagasc.ie/media/website/publications/2015/The-Spring-Barley-Guide.pdf

PHOSPHORUS DEFICIENCY SYMPTOMS

- Stunted growth.
- Purple tints on dark green leaves, veins, and stems.
- Symptoms first appear on older leaves, and these can die off early.

Phosphorus Deficiency symptoms
Photo courtesy of YARA

POTASH (K)

- K supply is essential for all nutrient uptake by the roots and movement to the leaves for photosynthesis.
- K is essential for the distribution of sugars and proteins made by the green tissue for plant growth and grain fill.
- For a plant to maximise its response to N, the crop must have access to and take up an adequate amount of plant-available K.
- Symptoms first appear on older leaves, and these can die off early.

Potash Deficiency symptoms
Photo courtesy of YARA

POTASH DEFICIENCY SYMPTOMS

- Plants are blue-ish green in colour and older leaves show chlorotic tips and margins followed by necrosis.
- Slow crop growth, inefficient interception of sunlight and photosynthetic production of assimilates means the crop does not grow rapidly.

Sulphur Deficiency symptoms
Photo courtesy of YARA

Manganese Deficiency symptoms
Photo courtesy of YARA

Copper Deficiency symptoms
Photo courtesy of YARA

Magnesium Deficiency symptoms
Photo courtesy of YARA

Boron Deficiency symptoms
Photo courtesy of YARA

Zinc Deficiency symptoms
Photo courtesy of YARA

P AND K APPLICATION

- Grain P and K analyses can help to provide better estimates of crop phosphate and potash offtakes, or standard book values can be used as an alternative. At P & K Index 2, these macronutrients can be applied when convenient during the year, but at lower Index values of 0 and 1, they should be applied annually and worked into the seedbed to ensure sufficient availability.

MACRO AND MICRO NUTRIENTS OF BARLEY

NUTRIENT	ROLE
MAGNESIUM (Mg)	Essential component of chlorophyll.
SULPHUR (S)	Important role in supporting nitrogen in protein production and is vital for high yields.
BORON (B)	Controls metabolic processes via the regulation of cell membranes. Important structural component of cell walls, where it controls porosity and tensile strength. Also has a role in pollen germination.
ZINC (Zn)	Component of enzymes involved in photosynthesis, sugar formation and protein synthesis.
MANGANESE (Mn)	Important role within photosynthetic processes.
COPPER (Cu)	Required for a range of different plant functions including production of viable pollen for grain production and maintenance of the cell wall structure.

BASF's David Leahy says
"Crop nutrition is a vital component for successfully achieving high yields in both winter and spring barley. Spring barley responds well to early applications of N and P, due to the fact that the crop hits the ground running. Potassium (K) is a vital element for stem and straw strength, and in reducing straw brackling. Trials in Ireland have shown, that crops that are low in K, are more prone to straw brackling and lodging."

RISK FACTORS	DEFICIENCY SYMPTOM	ANALYSIS METHODS *
Sandy soils, acidic soils, potassium rich soils or high K applications (through lock-up) as well as cold, wet periods.	Pale and chlorotic new leaves which can remain unopened. Beading of chlorophyll can be seen on leaves.	Soil
All sandy soils, loamy & coarse silty soils with medium to high winter rainfall or heavy and peaty soils with high rainfall.	Bright chlorotic yellow green colour and stunted growth. Chlorosis caused by the deficiency is observed on the youngest leaves first.	Tissue
Soil risk factors for deficiency include sandy soils with high organic matter and a pH above 7. Over-liming can trigger deficiency.	Dieback of the apical growing points on the main stem, followed by dieback of side shoots. Blind or extremely short ears with few grains and twisted awns.	Soil Tissue
Deficiency most common on light textured soils. High soil pH in conjunction with high soil P levels can result in lower zinc availability.	Change in colour from green to muddy grey green in central leaf areas, appearing on middle aged leaves. Older leaves will exhibit light brown necrotic spots often with a dark margin.	Soil Tissue
Risk factors: - deficient soils, low availability due to high pH, poor soil conditions, low soil temperature /moisture and loose seedbeds. A widespread deficiency in barley, with spring crops more susceptible than winter.	New leaves become pale and limp, followed by light grey flecking and striping which occurs at the base of the youngest fully opened leaf.	Tissue
Deficiencies are most often found in light textured, acidic or alkaline soils. Spring crops are more susceptible than winter to drought induced deficiency.	Old and new leaves affected; plants show: - A withered, pale appearance - Shrivelled grains - White awns	Soil

*Measuring nutrient concentrations in the grain can also be a useful method to build a picture of nutrient performance and identify deficiencies or limitations.

FULFIL YOUR YIELD POTENTIAL

AVOIDING LODGING AND BRACKLING

Dr Pete Berry, ADAS

AVOIDING LODGING

- Growing both winter and spring barley crops involves a balancing act between maximising yield, quality and minimising lodging risk.
- Severe lodging, if it occurs early or around flowering, can reduce yield by up to 50% and brackling which occurs later reduced yield by as much as 1.4 t/ha in ADAS trials.
- Lodging is also likely to mean greater drying requirements, reductions in grain quality and increased combining time, all resulting in additional costs, so ensuring lodging risk is minimised must be a priority for growers.

MECHANISMS OF LODGING

Three types of lodging commonly occur in winter and spring barley:

- **Root lodging:** When the root anchorage system fails.
- **Stem lodging:** When the stem buckles.
- **Brackling:** When the upper third of the stem buckles.

The primary causes of lodging are:
- A weak root anchorage system
- Weak stems
- A high leverage force exerted on the stems and roots arising from heavy heads and/or tall plants.

Root lodging is caused by rainfall softening the topsoil. Only 7 - 8 mm of rain is needed to wet the topsoil sufficiently to weaken it enough for lodging to occur.

The likelihood of **stem lodging** or **brackling** increases as the crop matures because stems become progressively weaker.

“ROOT LODGING IS THE MOST COMMON CAUSE OF EARLY LODGING WITH THE MOST DAMAGING YIELD EFFECTS.”

Root lodging

Stem lodging

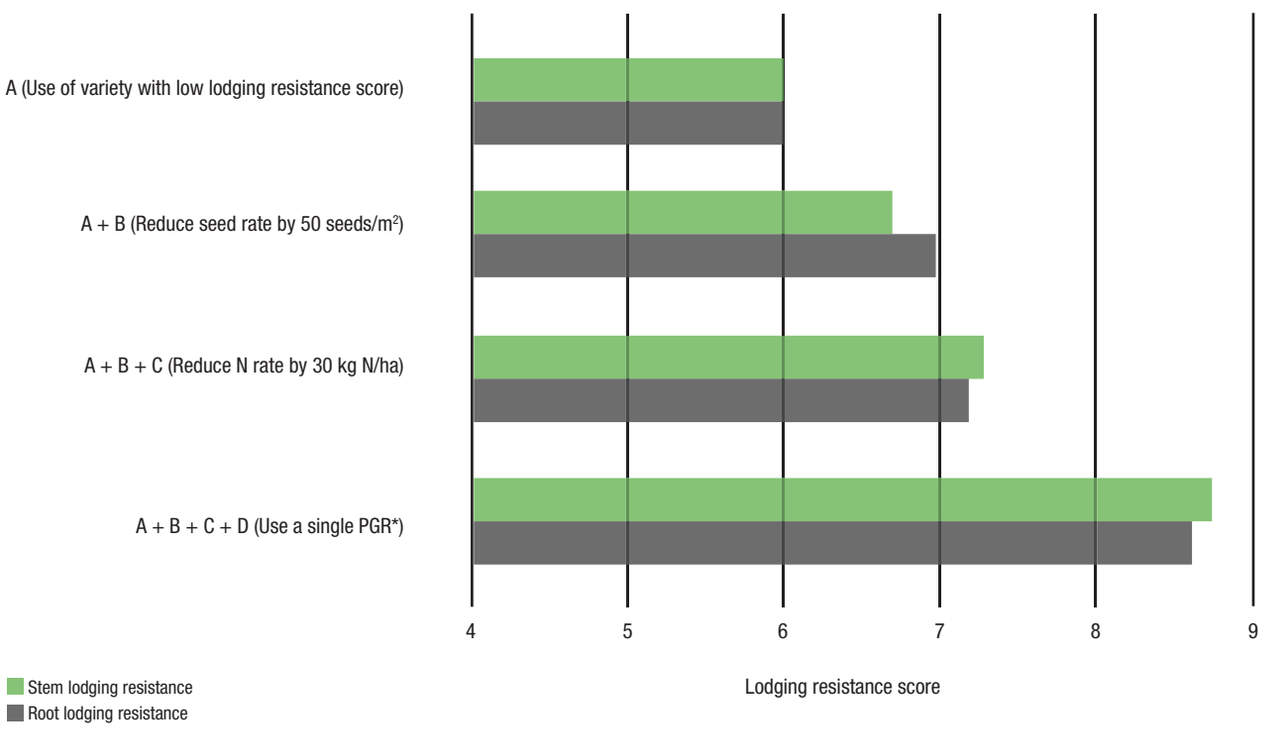
Brackling

EFFECT OF MANAGEMENT FACTORS ON THE VARIETAL LODGING RESISTANCE SCORE

	EFFECT ON THE VARIETAL LODGING RESISTANCE SCORE	
	Root lodging	**Stem lodging**
Decrease seed rate by 50 seeds/m²	Increase by 1 point	Increase by 0.75 points
***Decrease N rate by 30 kg N/ha**	Increase by 0.3 points	Increase by 0.6 points
A single PGR application	Increase by 1 to 2.5	Increase by 1 to 2.5

*Reducing N rate by 30 kg N/ha would be expected to reduce yield by 0.2 t/ha on average, compared with the N rate recommended by RB209.

EXAMPLE OF THE IMPACT OF CROP MANAGEMENT ON LODGING RESISTANCE



*Assume PGR shortens height by 8cm

REDUCING CROP HEIGHT BY JUST 5 CM IS SUFFICIENT TO INCREASE THE VARIETY LODGING RESISTANCE SCORE BY ONE POINT.

This in turn, can reduce the risk of lodging from one in every four years to one in seven.

A single plant growth regulator (PGR) application usually reduces height by between 4 cm and 8 cm, with a shortening of as much as 14 cm possible. When PGR applications are applied sequentially, for example GS30 and GS37, even greater height reductions are possible.

PREDICTING LODGING RISK

Crops with large canopies at GS30 are more prone to lodging because they produce plants with thin weak stems in the summer. An increase in the green area index (GAI) at GS30 from a typical value of about 1 unit to 1.5 units would be expected to reduce the varietal lodging resistance score by the equivalent of one point.

> **“CROPS WITH LARGE CANOPIES AT GS30 ARE MORE PRONE TO LODGING BECAUSE THEY PRODUCE PLANTS WITH THIN WEAK STEMS IN THE SUMMER.”**

GAI = 1 UNIT

GAI = 1.5 UNIT

IT’S POSSIBLE TO GET A ROUGH ESTIMATE OF GAI FROM THE FRACTION OF SOIL COVERED BY CROP USING THE TABLE BELOW.

FRACTION OF SOIL COVERED BY CROP	GAI ESTIMATE
ONE THIRD	0.5
ONE HALF	1.0
TWO THIRDS	1.5

BRACKLING AND STRAW QUALITY

Brackling occurs as the straw is drying out, with the upper third of the stem buckling at or around the nodal area, with yield losses of up to 1.4 t/ha.

- There is a varietal element to the risk of brackling and environmental factors play a role although, as of yet this is not fully understood.
- Ensuring a crop has adequate levels of Potassium (K) is also important in reducing brackling.

BASF

REVYSOL®, COMBINED WITH XEMIUM®, AVAILABLE IN REVYSTAR® XE OFFERS A GREAT OPTION ON STRAW BREAKDOWN, IMPROVING THE QUALITY OF YOUR STRAW.

Solatenol + prothiocaonzole

Bixafen + prothioconazole

Revysol® + Xemium®

LEARNING FROM EXPERIENCE

- Use previous lodging events as a guide for future lodging risk management.
- Some fields or parts of fields are often more prone to lodging than others, identify these.
- Identify whether the cause of lodging was stem or anchorage failure.
- Investigate the factors which may have caused this.

PGR PROGRAMMES

Growers should adopt a targeted approach to PGR applications.

- Base the strength of the programme on the risk of the crop

Consider:

1. Varietal lodging resistance score
2. Plant population
3. Level of residual nitrogen in the soil

THE INFLUENCE OF RISK FACTORS ON SUGGESTED NUMBER OF PGR APPLICATIONS

	SUGGESTED NUMBER OF PGR APPLICATIONS	
Risk factors	**Spring barley**	**Winter barley**
Low plant population Low soil residual N High lodging resistance rating	0 - 1	1 - 2
High plant population High soil residual N Low lodging resistance rating	1 - 2	2 - 3

“USING DIFFERENT, COMPLIMENTARY ACTIVES IN THE PGR PROGRAMME, WITH DIFFERENT MECHANISMS OF ACTION WILL GENERALLY GIVE MORE CONSISTENT SHORTENING, AS WILL HAVING MORE THAN ONE SPLIT.”

APPLICATION TIMING FOR HEIGHT REDUCTION

Moderate risk – One PGR application might be enough.

Winter and spring barley – Applying PGRs between the point when the stem starts extending and around GS37, will shorten the stem and reduce the risk of lodging.

High risk – Generally a two spray programme would be appropriate.

Winter and spring barley

- Easy to get two sprays applied because there is a relatively long time period between GS30 and GS37.
- In a three spray programme the first split would be at end of tillering, the second at GS31 and the last split at GS37-45.

Spring barley - This crop can race through the growth stages GS30-GS37, often making it logistically challenging to get two PGR's applied in that period.

KEY ACTIVES

All PGR actives are effective at reducing stem extension.

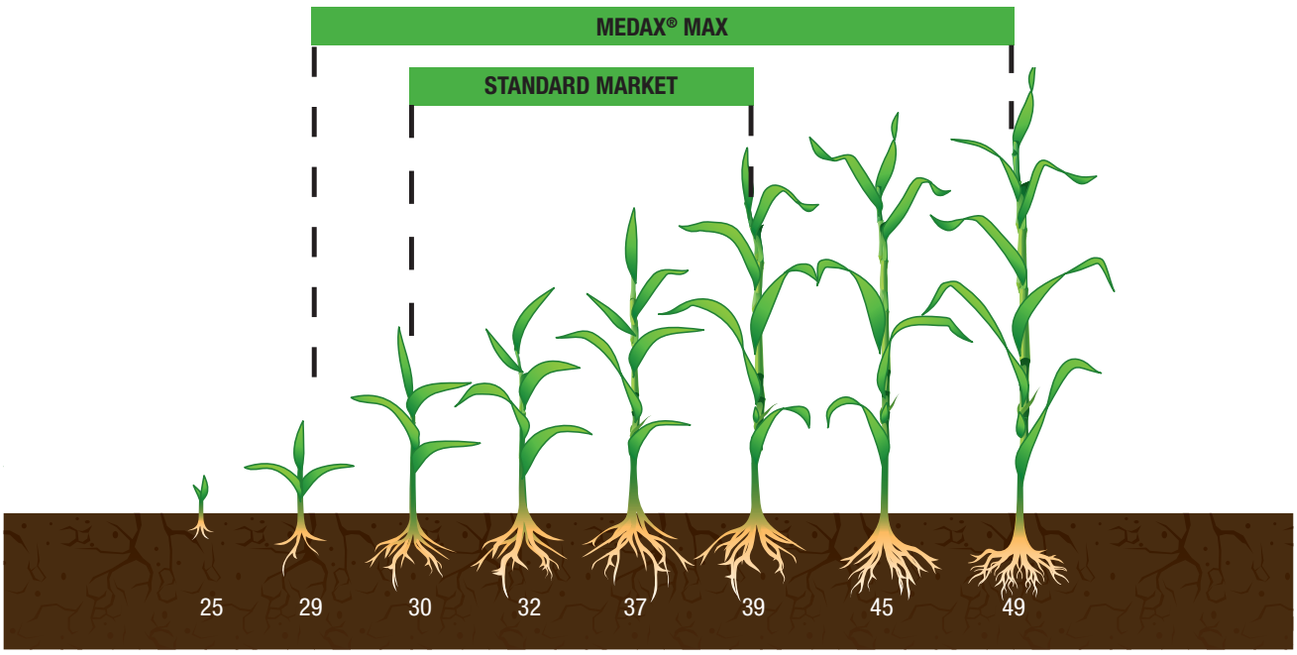
- PGRs containing actives that inhibit gibberellic acid (E.g., **prohexadione**) are particularly effective at shortening lower and mid internodes.
- PGRs containing **ethephon** are effective at shortening mid and upper internodes.
- ADAS research has found an application of **Terpal® (mepiquat chloride + 2-chloroethylphosphonic acid) or Medax® Max (prohexadione + trinexapac ethyl)** at GS37 will minimise the risk of brackling.
- **Chlormequat** has the potential for tiller manipulation, as do other actives, however, it should not be relied on for a big shortening effect as its impact on stem height is not as strong as other actives that are available.

TILLER MANIPULATION

There is also potential for tiller manipulation by reducing apical dominance, if the active used has inhibitory effects on gibberellic acid, then there is the potential to stimulate tillering.

PGR applications need to be done at or just prior to GS30. Check the label of the PGR to ensure it can be used prior to GS30.

If there are newly stimulated tillers, then growers need to manage these to ensure they survive; they may require more N fertiliser or a regular fertiliser application. Rolling the crop between GS25-30 can also help suppress apical dominance. This should only be considered if ground and crop conditions allow.



MEDAX® MAX DELIVERS ACROSS ALL TIMINGS

Image demonstrating the application window available to Medax® Max.

UTILISING YOUR PGRS

BASF

BASF PGR's **Medax® Max** and **Canopy®** are flexible for all situations. With both PGRs containing two complementary actives for speed of uptake and long-life activity.

Both **Medax® Max** and **Canopy®**:

- Work well in cooler T0/T1 conditions (down to 5˚C).
- Work across a broad range of crops on label and have wide applications window.
- Give benefits beyond height reduction: thickening stems and stem wall, increasing root plate spread for anchorage strength and increasing fine roots for better nutrient uptake.

It's important to learn from previous seasons. In autumns such as 2023 where there was poor rooting and no lower structural support for crops, strategic use of PGRs will divert energy away from apical growth and into rooting and tillering.

As shown below **Medax® Max** provides wider root spread for better anchorage, enhancing water and nutrient supply for stronger, healthier crops.

Untreated

0.3 kg Medax® Max

0.6 kg Medax® Max

BASF barley dose rate options- Medax® Max and Canopy®.

		T0 (GS 30)	T1 (GS 31-32)	T2 (GS 37-41)	MAX TOTAL DOSE
MEDAX MAX®	Winter barley	0.4 KG/HA	0.4 KG/HA	0.3 KG/HA	1.5 KG/HA
	Spring barley	0.3 KG/HA	0.3 KG/HA	0.3 KG/HA	0.75 KG/HA
CANOPY®	Winter barley	0.3 L/HA	0.75 L/HA	0.6 L/HA	1.5 L/HA
	Spring barley	0.3 L/HA	0.4 L/HA	0.6 L/HA	1.5 L/HA

Dose rates above are not programme recommendations but dose rate options at each application timing

DISEASE MANAGEMENT STRATEGIES

Dr Neil Havis, SRUC, Dr Steven Kildea, Teagasc

The medium to long-term control of many barley diseases depends on good genetic resistance in the plant together with cultural conditions and the judicious use of fungicides as part of an integrated pest management (IPM) programme.

IPM – THE KEY PRINCIPLES

1. Choose to grow resistant varieties
2. Extend rotations to avoid carryover of some diseases
3. Minimise crop trash, stubble, and volunteers
4. Be aware that early-sown crops will be at more risk and manage accordingly
5. Manage nitrogen carefully, thick canopies are more conducive to disease spread
6. Consider the use of protectant fungicides and practice resistance management

KEY TIMINGS FOR FUNGICIDE APPLICATIONS

When devising a fungicide program, it is crucial to consider the appropriate chemistry that matches the specific disease and its associated risk. This risk can vary depending on the season. Additionally, timing the application of fungicides correctly is essential for the success of the program. By aligning disease risk, timing, and chemistry effectively, the fungicide program can be optimised for maximum effectiveness.

KEY TIMING SUMMARY:

WINTER BARLEY

TIMING	GOAL	GROWTH STAGE
T0 – Considered if disease levels coming out of winter are high.	Control overwintered disease. Protect leaves and tillers.	**Ireland** – Typically not considered **UK** – GS25-30
T1 – Important timing where yield response is greatest.	Protect leaves and tillers creating yield potential.	**Ireland** – GS25-30 **UK** – GS31- Stem Extension.
T1.5 – Considered if timings between T1 and T2 get stretched.	In a high disease pressure season, this can maintain primary disease control and improve Ramularia control.	**Ireland** – GS32-39 **UK** – Typically not considered
T2 – For upper canopy disease control and Ramularia control.	Protect the flag leaf Prolong canopy duration.	GS39-49 **GS45 =Optimum Flag leaf fully emerged and awns peeping.**

SPRING BARLEY

TIMING	GOAL	GROWTH STAGE
T1 – Important timing where yield response is greatest.	Protect leaves and tillers creating yield potential.	**Ireland** – GS25-30 **UK** – GS31- Stem Extension.
T2 – For upper canopy disease control and Ramularia control.	Protect the flag leaf Prolong canopy duration.	GS39-49 **GS45 = Optimum Flag leaf fully emerged and awns peeping.**

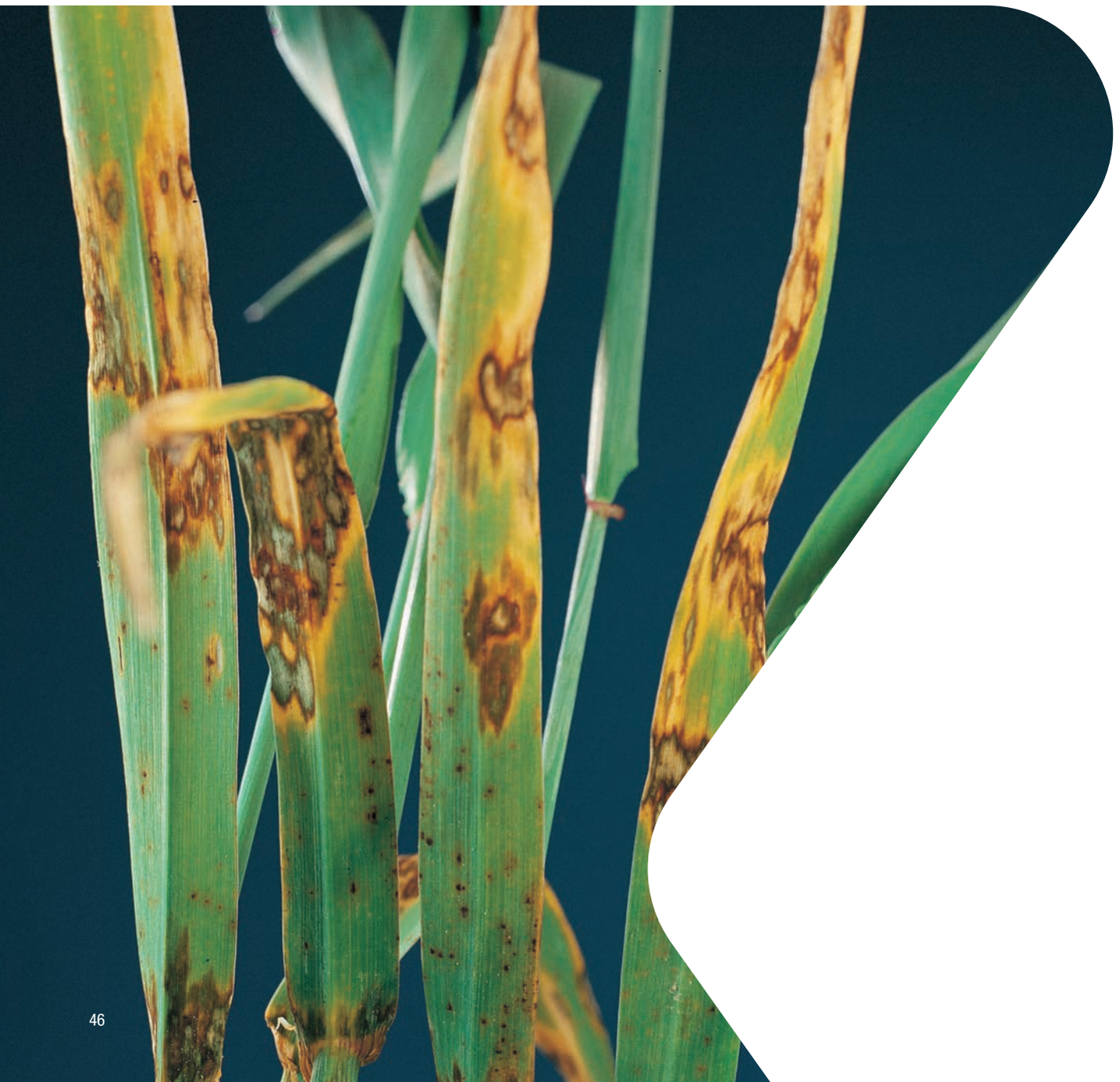
RHYNCHOSPORIUM

In the UK and Ireland Rhynchosporium is a major yield robbing disease of barley, which spreads easily in both winter and spring crops under favourable conditions, causing rapid loss of green leaf area.

LIFECYCLE

Rhynchosporium can be seed borne or trash borne, where it can survive for up to a year in crop debris.
Spores are spread by rainsplash from infected trash, stubble, and volunteers. Rainsplash continues to spread the disease up the canopy, to the new growth, cycling every 14 days, and can cause several infection cycles during the growing season. The disease favours cool, moist conditions and can be a big issue in both the autumn and spring months. Warm conditions, above 25°C, checks the disease.

RHYNCHOSPORIUM CAN CAUSE UP TO 50% OF THE FLAG LEAF TO BE LOST, DEVASTATING YOUR FINAL YIELD.



RHYNCHOSPORIUM - YIELD LOSS AND SYMPTOMS

Rhynchosporium impacts crops in two ways:

1. Decreasing grain set if the disease is in the crop early.
2. Decreasing final green leaf area.

The disease starts as a grey green water-soaked lesion on the leaf. The centre of the lesion, which is irregular in shape, becomes whiter, with a dark edge. Lesions extend and expand across the leaf.

Because Rhynchosporium is spread outwards as well as upwards by rainsplash from an initial infection point, the disease is seen in patches across a field.

In winter barley where disease pressure is high, the disease is often seen from November onwards.

In spring barley unless the crop has been sown early, it is unusual to see symptoms during tillering.

“YIELD REDUCTIONS ARE SUBSTANTIAL, UP TO 30% IN WINTER BARLEY.”

RISK FACTORS AFFECTING DISEASE SEVERITY AND POTENTIAL MANAGEMENT SOLUTIONS

RISK FACTOR	SOLUTION
Location - wetter and cooler regions.	
Tight rotations - previous barley crops provide inoculum sources through trash stubble and volunteers.	• Extend the rotation.
Infected barley seed, trash, stubble, volunteers, and grasses, especially ryegrass - provide sources of inoculum.	• Grow varieties with a high resistance rating and avoid saving seed from infected crops. • Take off as much of the straw as possible. • Stale seed beds. • Use certified seed and do not grow seed from heavily infested crops.
Reduced tillage, where trash remains on the soil surface - acts as a source of inoculum.	• Take off as much of the straw as possible. • Be aware of the risks of your establishment system.
Nitrogen - Thick canopies can aid rainsplash and development of the disease.	• Be aware and manage risk.
Very early sowing - Allows for earlier infection and more time for the disease to develop in the plant.	• Be aware that early-sown crops will be more at risk and manage accordingly.
Nearby infected crops - Spores can be spread by the wind to infect other crops.	• Separate crops and maintain a high level of farm hygiene.

CHEMICAL CONTROL - RHYNCHOSPORIUM

KEY TIMINGS:

Winter barley

- **T0 GS25-30:**
  If Rhynchosporium is already visible.
- **T1 Ireland GS25-30:**
  Vary rate depending on disease levels.
- **T2 GS39-49:**
  (GS45 - awns emerging = optimum):
  Vary rate depending on disease levels.

Spring barley

- **T1 UK GS31 - Stem Extension:**
  Check disease levels.
- **T1 Ireland GS25-30:**
  Vary rate depending on disease levels.
- **T2 GS39-49 (GS45- awns emerging = optimum):**
  Vary rate depending on disease levels.

Key controls for Rhynchosporium

- Xemium®
- Prothioconazole
- SDHI azole mixes

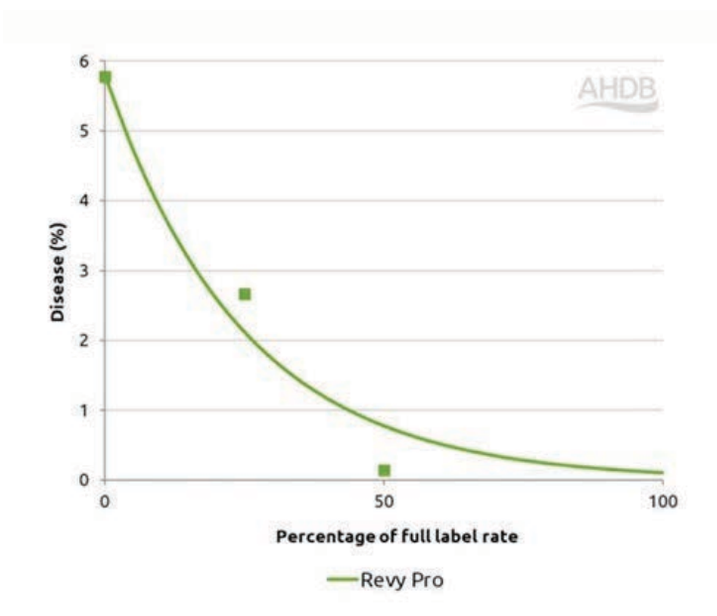
BASF products that contain these AIs:

- RevyPro® (Revysol® + prothioconazole)
- Revystar® XE (Revysol® +Xemium®)

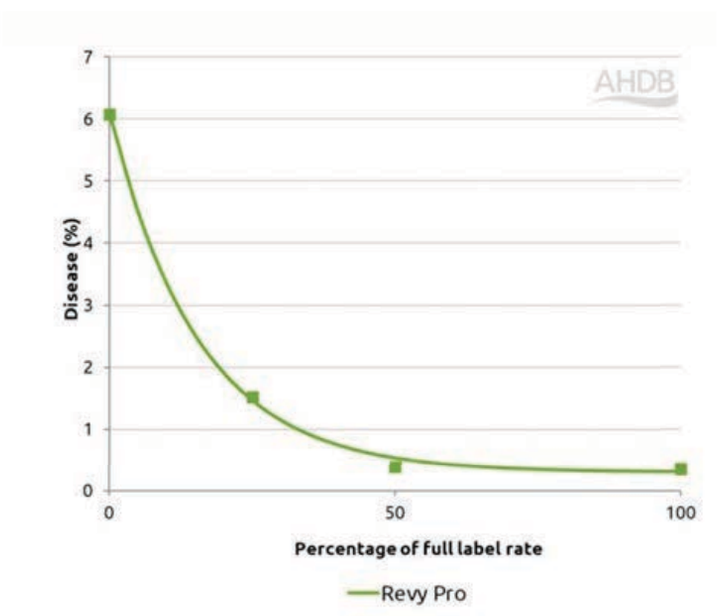
ROBUST RHYNCHOSPORIUM CONTROL

The introduction of RevyPro® provides another strong product for Rhynchosporium control. The AHDB curves below demonstrate the value of RevyPro® when Rhynchosporium is present.

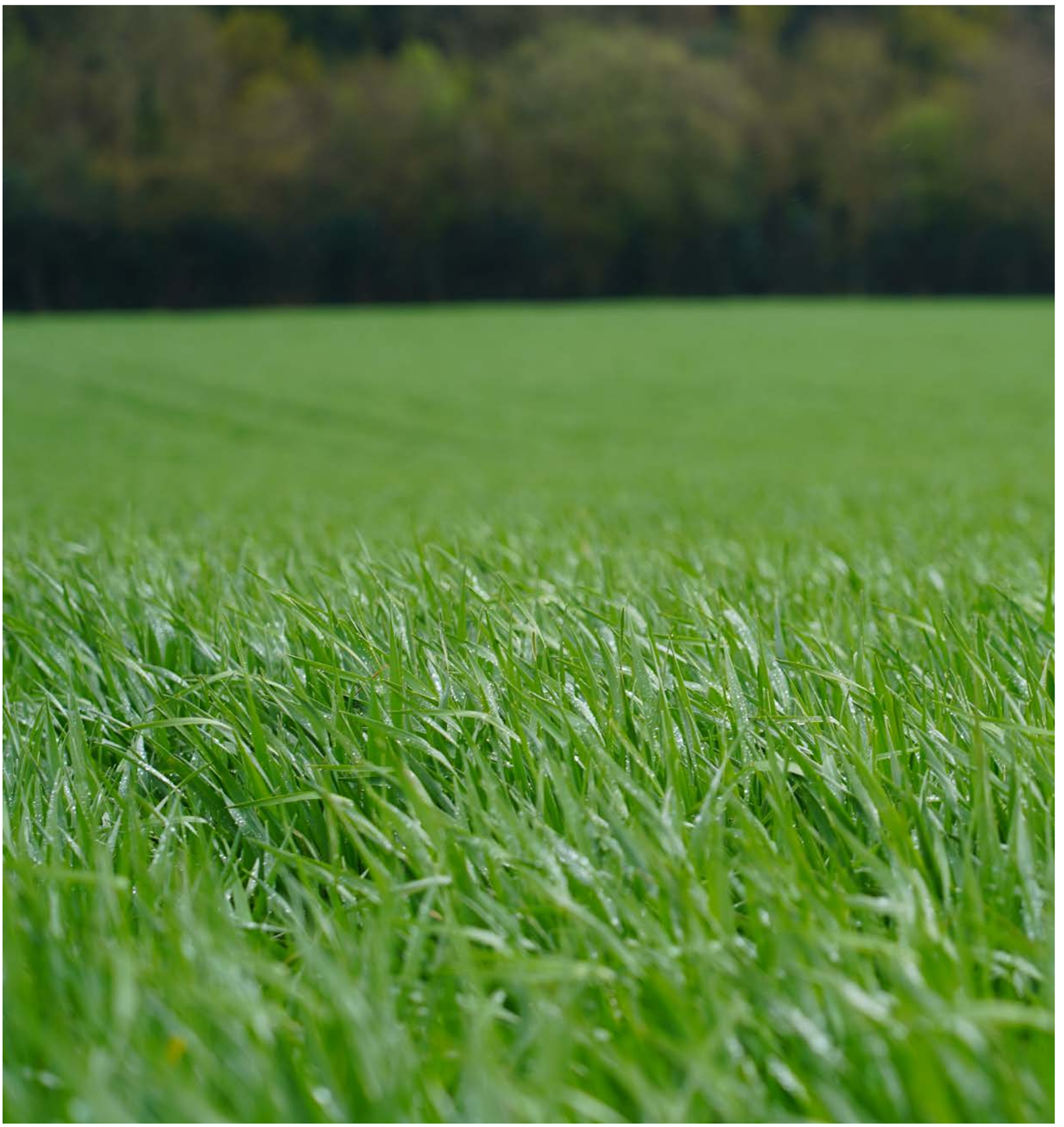
Rhynchosporium protectant 2025 (2 trials)



Rhynchosporium eradicant 2025 (3 trials)



Reference: AHDB, 2025 Fungicide performance in barley.



NET BLOTCH

LIFECYCLE

Warm, wet, conditions favours the spread of net blotch as well as air currents that help move the conidia around. The disease is seed and trash borne. Rainsplash dispersal moves the disease up the plant.
Higher temperatures and dry weather inhibit infection, with the disease cycle complete in 14 days, during optimal conditions.

There are two types of net blotch:
1 The spot form
2. The net form

SYMPTOMS & LOSSES

The net form looks like a net with darkened lesions that form on the leaves crossing leaf veins resulting in a net appearance. The spot form stays more of a round shape, sometimes stretching along the leaf. All lesions have yellowing associated with them, especially where symptoms are severe. Late attacks can also affect the glumes and awns, producing dark brown flecking and striping.

Net blotch impacts crops in two ways:
1. **Decreasing grain set if the disease is in the crop early.**
2. **Decreasing final green leaf area.**

UNDERSTANDING THE DEVELOPMENT OF NET BLOTCH WITHIN BARLEY CROPS

1.
Seed borne mycelum infects the coleoptile and the first leaf becomes infected as it emerges.
Inoculum developed within stubble is splash borne up the plant.

NET BLOTCH CAN CAUSE LOSSES OF BETWEEN 10 – 40% AS WELL AS LOSS OF QUALITY

Net form of net blotch

Spot form of net blotch

Survival on colonised barley stubble and trash.

2.
Spores produced on the leaf allow the disease to spread to other leaves and surrounding plants.

3.
Typical symptoms (stripe form and spot form) become readily apparent.

4.
Disease spreads to upper leaves and seed.

5.

RISK FACTORS AFFECTING DISEASE SEVERITY AND POTENTIAL MANAGEMENT SOLUTIONS

	RISK FACTOR	SOLUTION
VARIETY	Susceptible varieties can allow the disease to develop.	**CHOOSE RESISTANT VARIETIES** In the UK net blotch resistance ratings are only available for winter barley varieties.
TIGHT ROTATIONS	Previous barley crops provide inoculum sources through trash stubble and volunteers.	**EXTEND THE ROTATION**
INFECTED BARELY Seed, trash, stubble, volunteers, and grasses, especially Ryegrass	Provide sources of inoculum.	**GROW VARIETIES WITH A HIGH RESISTANCE RATING AND AVOID SAVING SEED FROM INFECTED CROPS** • Use certified seed, which should have been treated with an appropriate seed treatment if net blotch was found. Do not grow seed from heavily infested crops. • Take off as much of the straw as possible. • Stale seed beds.
REDUCED TILLAGE Where trash remains on the soil surface	Acts as a source of inoculum.	**TAKE OFF AS MUCH OF THE STRAW AS POSSIBLE** • Be aware of the risks of your establishment system.
EARLY SOWING	Allows for earlier infection and more time for the disease to develop in the plant.	**BE AWARE THAT EARLY-SOWN CROPS WILL BE AT MORE RISK AND MANAGE ACCORDINGLY.**

CHEMICAL CONTROL - NET BLOTCH

KEY TIMINGS

Winter barley

- **T0 GS25-30:**
  If net blotch is visible in the spring
- **T1 GS31-32:**
  Apply as protectant or if disease present
- **T2 GS39-49:**
  Apply as protectant or if disease present

Spring barley

- **T1 UK GS31- Stem extension:**
  Check disease levels
- **T1 Ireland GS25-30:**
  Vary rate depending on disease levels
- **T2 GS39-49 (GS45 - awns emerging = optimum):**
  Vary rate depending on disease levels.

Key controls for net blotch

- F500®
- Revysol®
- Xemium®
- SDHI strob azole mix
- Prothioconazole

BASF products that contain these AIs:

- Comet® 200 (F500®)
- RevyPro® (Revysol® + prothioconazole)
- Revystar® XE (Revysol® + Xemium®)

THE MOST EFFECTIVE OPTION FOR NET BLOTCH CONTROL

Trials in Ireland show that **RevyPro® + F500®** delivers very strong net blotch control in extremely high-pressure situations. F500® is a very strong single active to control net blotch and only further strengthens the control delivered by RevyPro®.

Prothioconazole (125 g)

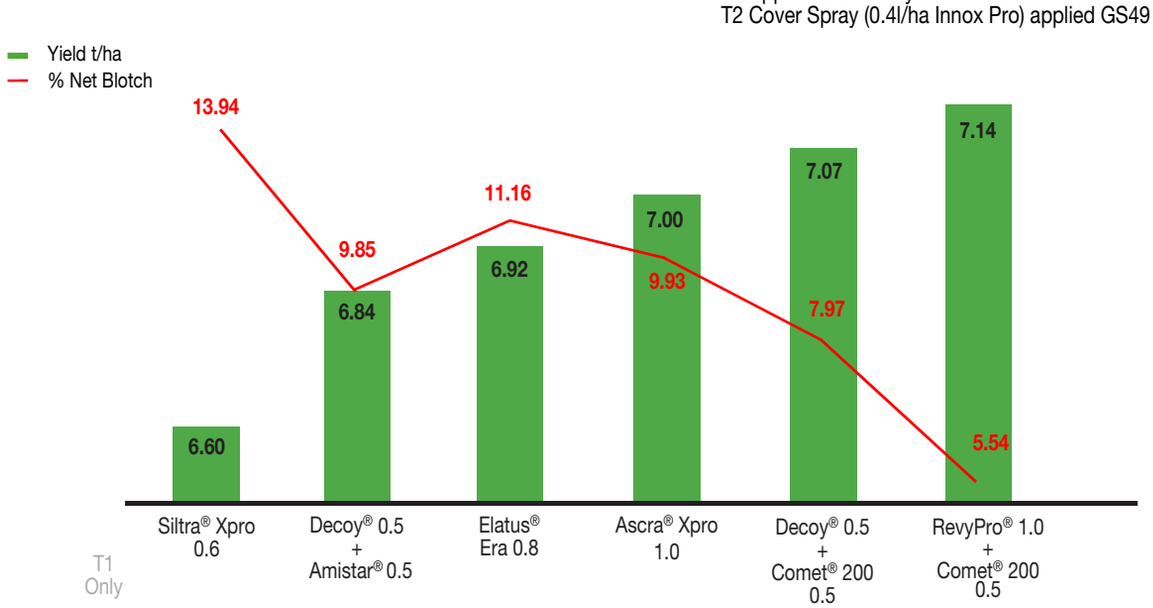
Elatus® Era (0.8l/ha)

Ascra® Xpro (1l/ha)

Untreated

RevyPro® (1l/ha) + Comet® 200 (0.5l/ha)

Variety: RGT Planet (spring barley), Avoca, County Wicklow, 2024.
T1 Applied GS33 May 30th
T2 Cover Spray (0.4l/ha Innox Pro) applied GS49 June 17th



Var; *RGT Planet* 2023 and 2024
N=2 Eurofins (Tullow, Co. Carlow), Eurofins (Arkow, Co. Wicklow)
Single application only at GS37
Untreated; 5.6 t/ha, 63% Net Blotch

BROWN RUST

LIFECYCLE

Overwinters on living plants, brown rust does not survive on crop trash.

SYMPTOMS AND LOSSES

Initially a speckled appearance of light green spots on the leaf before eventually orange pustules start to appear, completely randomly on the leaf. This is how brown rust can be distinguished from yellow rust, as in this disease the pustules form stripes.

CHEMICAL CONTROL - BROWN RUST

KEY TIMINGS

Winter barley

- **T0 GS25-30:**
  To knock out inoculum if disease pressure is high
- **T1 GS31-32:**
  Apply appropriate treatment if the disease is present
- **T2 GS39-49:**
  Apply appropriate treatment if the disease is present

Spring barley

- **T2 GS39-49 (GS45 - awns emerging = optimum):**
  Brown rust appears later in the season as temperatures pick up

Key controls for Brown rust

Brown rust is easily controlled by the same actives for Rhynchosporium and net blotch.

- F500®
- Prothioconazole
- SDHI azole mix

BASF products that contain these AIs:

- Comet® 200 (F500®)
- RevyPro® (Revysol® + prothioconazole)
- Revystar® XE (Revysol® + Xemium®)

RISK FACTORS AFFECTING DISEASE SEVERITY AND POTENTIAL MANAGEMENT SOLUTIONS

	RISK FACTOR	SOLUTION
VARIETY	Susceptible varieties can allow the disease to develop.	Consider a mixture of varieties in winter barley grown for feed.
VOLUNTEERS	Act as a source of inoculum.	Employ a stale seed bed.
VERY EARLY SOWING	Allows for earlier infection and more time for the disease to develop in the plant.	Be aware that early-sown crops will be at more risk and manage accordingly.

POWDERY MILDEW

Affects mainly winter barley crops. In spring barley, mildew is no longer an issue as almost all varieties on the AHDB Recommended List (UK) and DAFM recommended (Ireland) have been bred with mildew resistance locus o (MLO) genetic resistance. Powdery mildew is generally a background disease but has the potential to explode in favourable conditions.

LIFECYCLE AND SYMPTOMS

- White masses of fungus form pustules on the leaf surface, stems and ears.
- From these pustules, conidia grow in chains and stick up in the air to disperse spores.
- Warm conditions, high humidity, (90%) and air movement favour their dispersal. Spores then germinate when they land on a new leaf infecting the plant. The fungus can go through its life cycle in 7-14 days.
- Mildew overwinters on trash and on volunteers.

GREEN BRIDGE EFFECT

If winter barley crops are sown early, the crop germinates and starts to grow when there are still spores around from the spring crop. These spores infect the winter crop and then next spring the mildew infection goes from the winter crop back onto the spring crop.

RISK FACTORS AFFECTING DISEASE SEVERITY AND POTENTIAL MANAGEMENT SOLUTIONS

	RISK FACTOR	SOLUTION
VARIETY	Susceptible varieties can allow the disease to develop.	Consider a mixture of varieties in winter barley grown for feed.
VOLUNTEERS	Act as a source of inoculum.	Employ a stale seed bed.
VERY EARLY SOWING	Allows for earlier infection and more time for the disease to develop.	Be aware that early-sown crops will be at more risk and manage accordingly.

CHEMICAL CONTROL - POWDERY MILDEW

KEY TIMINGS

Winter barley

- **T0 GS25-30:**
  If there are large amounts of the disease in the crop
- **T1 GS31-32:**
  If there are large amounts of the disease in the crop

Key controls for powdery mildew

- Metrafenone - preventative only.
- Cyflamid - Use a specific mildewicide if the disease is severe and the only target.
- Prothioconazole and mefentrifluconazole (Revysol®) - Use chemistry that controls Rhynchosporium and also has some activity on mildew.

BASF products that contain these AIs:

- RevyPro® (Revysol® + prothioconazole)
- Revystar® XE (Revysol® + Xemium®)

RAMULARIA

> “RAMULARIA AFFECTS BOTH WINTER AND SPRING BARLEY”

LIFECYCLE

Created by Fiona Burnett, SRUC

1.
GS0
Ramularia seed-borne.

RAMULARIA DISEASE DEVELOPMENT

6.
GS75-83
Ramularia symptoms on heads and awns.

5.
GS65
Fungus detected inside leaves 2-4 weeks before symptoms appear.

2.
GS10-13
Ramularia detectable by diagnostics but no visual symptoms.

> **“A PROGRAMMED APPROACH IS CENTRAL TO ENSURING OPTIMAL RAMULARIA CONTROL”**
>
> BASF’s David Leahy

3.
GS25-30
T1 can reduce onset
GS 27-30
Ramularia spots on dying leaves.

4.
GS45-49
Protect crops with fungicide.

SYMPTOMS AND LOSSES

Ramularia is differentiated from other diseases by the **5Rs:**

- **R**eddish Brown
- **R**ectangular lesion
- **R**ing of yellowing or chlorosis around the lesion
- **R**estricted by leaf veins
- **R**ight through the leaf

In Scotland, generally Ramularia is not seen until after the plant has flowered, GS72 onwards. In Ireland, it has been seen in the lower leaves of the crop at the start of stem extension.

Yield losses can be as high as 2-2.5 t/ha in winter barley and 1.5 t/ha in the spring crop.

GROWERS ARE MORE AWARE OF RAMULARIA NOW, BECAUSE OTHER DISEASES HAVE BEEN CONTROLLED, THE GROWING SEASON HAS BEEN EXTENDED AND SOWING IS HAPPENING 2-3 WEEKS EARLIER HISTORICALLY.

RISK FACTORS AFFECTING DISEASE SEVERITY

	RISK
LOCATION	Local environmental conditions and microclimate.
WEATHER	Warm wet growing conditions increase severity.

BASF's David Leahy says...

IPM STRATEGIES ARE NOT DESIGNED FOR THIS DISEASE AS NOT ENOUGH IS KNOWN ABOUT IT.

Crop stress factors like BYDV, take-all, frost damage, spray scorch and late PGR applications can also exacerbate Ramularia, if the right climatic conditions subsequently prevail.

If the crop is healthy with optimal amounts of water, macro and micronutrients then it is likely that this will assist in resisting disease, however, it is flowering and the resultant change in plant physiology that is the key stress for ramularia.

CHEMICAL CONTROL - RAMULARIA

KEY TIMINGS

Fungicide application must be preventative

Winter barley

- **T2 GS39-45** (GS45 = Optimum) – booting to awns peeping

Spring barley

- **T2** – booting to awns peeping (no later than GS45 in a crop being grown for malting)

Key controls for Ramularia

- Revysol® (mefentrifluconazole)
- Prothioconazole
- Adepidyn®
- Folpet*

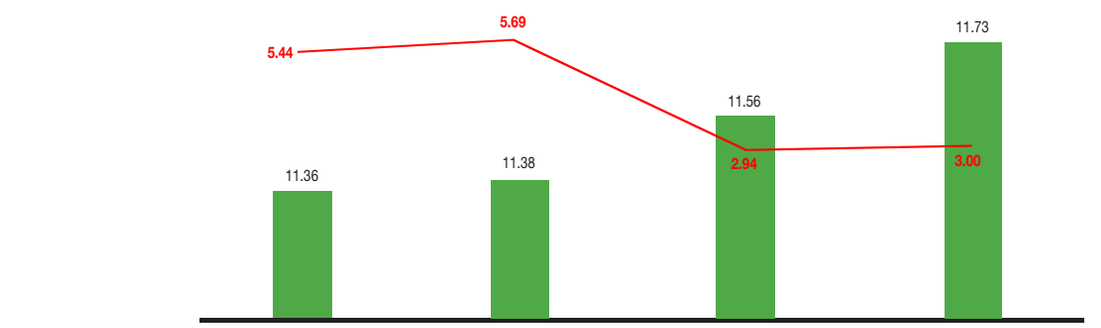
*Some trial evidence suggests that folpet at T2 will improve control of Ramularia in high pressure scenarios

BASF products that contain these AIs:

- RevyPro® (Revysol® + prothioconazole)
- Revystar® XE (Revysol® + Xemium®)

Percentage Ramularia on leaf 2

Yield t/ha



Azole	130g Ptz	125g Ptz	100g Ptz + 50g Revysol®	100g Revysol®
SDHI	65g Fluopyram + 65g Bixafen	75g Xemium®		50g Xemium®
		150g F500®		

Crop Plot Trial: Cork Ireland
Var; Integral, Winter Barley
T1 GS 30/31 April 19th
T2 GS 45/49 May 11th (shown in table above)

Trials show the reduction in Ramularia present on leaf 2 when Revysol® is in the treatment. This results in increased yield across both Revysol® based treatments.

REVYSOL® - RAMULARIA CONTROL

BASF

Revysol® displays a high level of efficacy on Ramularia and is available in RevyPro® and Revystar® XE.

Untreated

RevyPro® 1L

Shangagarry. County Cork. July 2nd 2024
Variety: Integral (BYDV tolerant), Winter Barley
T1 Cover spray applied GS32 mid-April
T2 Treatments GS45 May 11th

REVYPRO®

BASF

BASF are pleased to introduce RevyPro®, a new fungicide option for the barley market. RevyPro® combines the two leading azoles in barley, Revysol® + prothioconazole to provide well balanced barley disease control.

The complementary activity of Revysol® (strong on Ramularia) and prothioconazole (strong on Rhynchosporium and net blotch) brings a solution which bolsters your barley options.

Broad spectrum barley disease control from RevyPro®

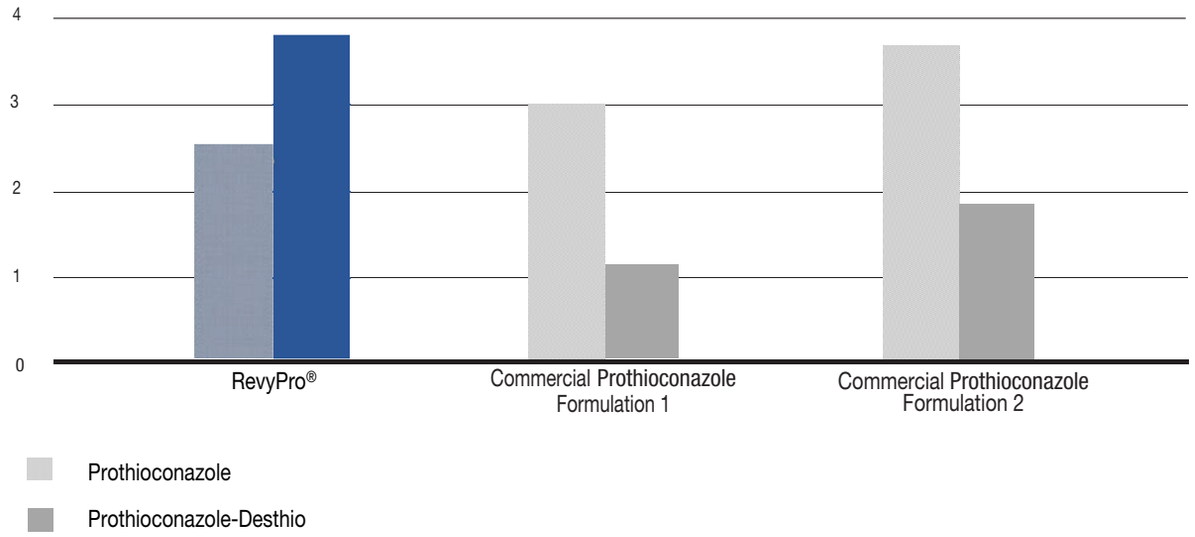
Source: Efficacy of RevyPro® vs. its single active ingredient
Transport data added Aug 2024 (n=34; European summary) Rhyncho data added Aug 2024 (n=11; European summary)

The formulation

The formulation of RevyPro® is unique as it enables a quicker activation to be achieved, leading to enhanced initial activity and better protection from wash-off and UV degradation. This means higher amounts of prothioconazole-desthio for enhanced activity, beyond what is possible in other prothioconazole mixes. Prothioconazole-desthio is the main metabolite responsible for the fungicide action within prothioconazole containing products.

The chart below shows that despite the same applied amount of prothioconazole across three different products, RevyPro® is able to convert the most prothioconazole into the prothioconazole-desthio. This will result in greater performance.

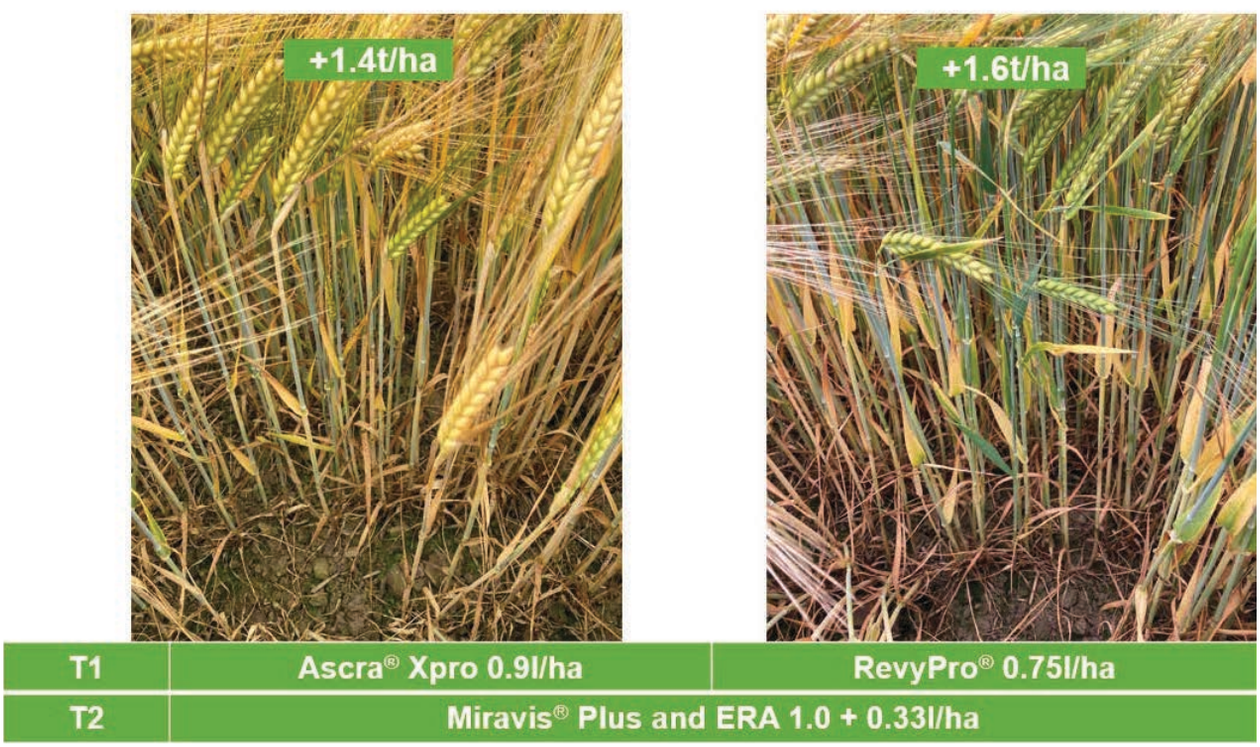
Analytical quantification 24h after application (mg/kg leaves)



BASF Trial: Analytical quantification 24 hours after application (mg/kg leaf dry matter): applied amount = 150g ai/ha prothioconazole for all products.

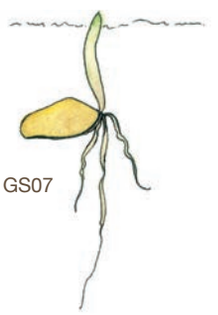
RevyPro® in the field

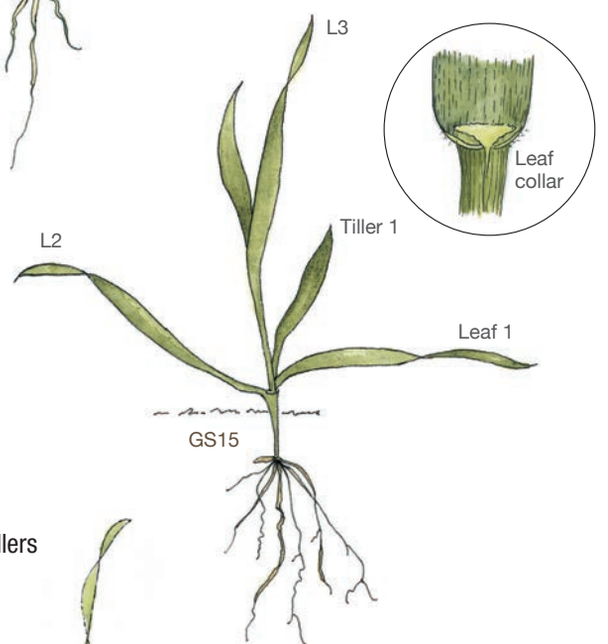
The unique formulation of RevyPro® leads to results in field. Trials in 2025 illustrate the control RevyPro® is giving and the subs equent yield advantage of using it. In addition, we see the flexibility and greening benefit of RevyPro®.



Scottish Agronomy Trials - Fife. Photos taken 25/06/2025.
Untreated yield: 9.3 t/ha

CEREAL GROWTH STAGES AND BENCHMARKS





GERMINATION

GS07 Germinating seed with root (which forms first) and shoot.

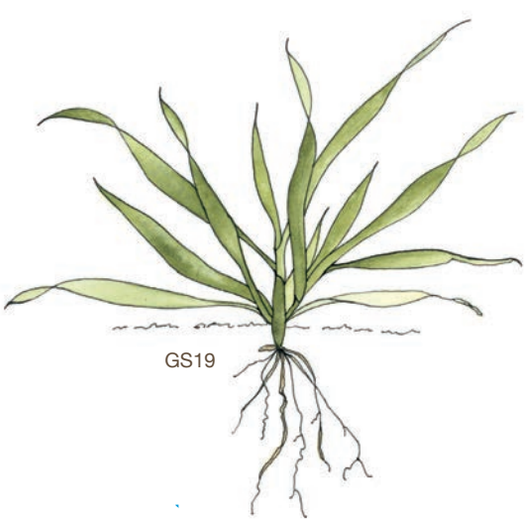
SEEDLING GROWTH

GS10 First leaf through coleoptile
GS11 First leaf unfolded (ligule visible)
GS13 Three leaves unfolded on the main shoot
GS15 Five leaves unfolded
GS19 Nine or more leaves unfolded on the main stem

A leaf is unfolded when its leaf collar, at the junction between blade and sheath, has emerged from the sheath of the preceding leaf.

TILLERING

GS20 Main shoot only
GS21 Main shoot and one tiller
GS23 Main shoot and three tillers
GS25 Main shoot and five tillers
GS29 Main shoot and nine or more tillers



GS21	OVERALL	SOUTH	NORTH
Main shoot and one tiller	13 November	10 November	15 November
Plants/m²	305	277	327
GAI	0.3	0.3	0.3

STEM ELONGATION

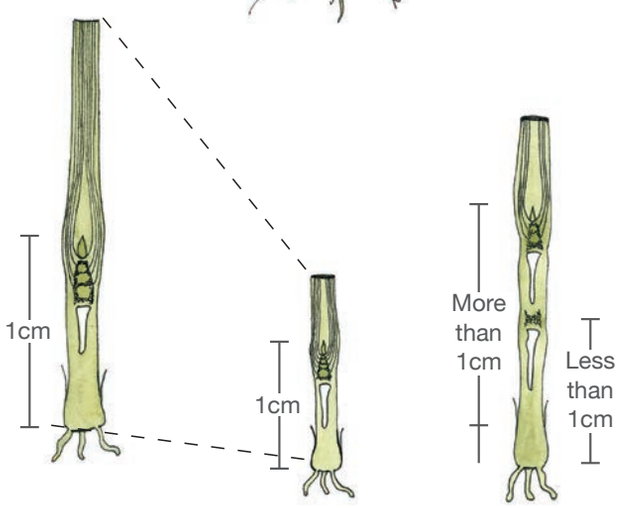
GS30 Ear at 1 cm (pseudostem erect)
GS31 First node detectable
GS33 Third node detectable
GS37 Flag leaf just visible
GS39 Flag leaf blade all visible

Distance between base of the plant and the top of the shoot apex on the main stem is 1 cm or more, but the length of the 1st internode is less than 1 cm...

When stem elongation begins it is necessary to split the main shoot to determine the correct crop Growth Stage.

For a quick, but crude assessment, fold back the leaf sheaths then count the slight 'bumps' caused by each node.

The exact stage is revealed by stripping off leaves and cutting the main stem longitudinally with a sharp knife.



When stem elongation begins it is necessary to split the main shoot to determine the correct crop Growth Stage.

For a quick, but crude assessment, fold back the leaf sheaths then count the slight 'bumps' caused by each node.

The exact stage is revealed by stripping off leaves and cutting the main stem longitudinally with a sharp knife.

GS30	OVERALL	SOUTH	NORTH
Ear at 1cm	2 April	31 March	5 April
GAI	1.4	1.6	1.3
Shoots/m² (Shoot numbers start to decrease)	0.3	0.3	0.3

GROWTH STAGE 31

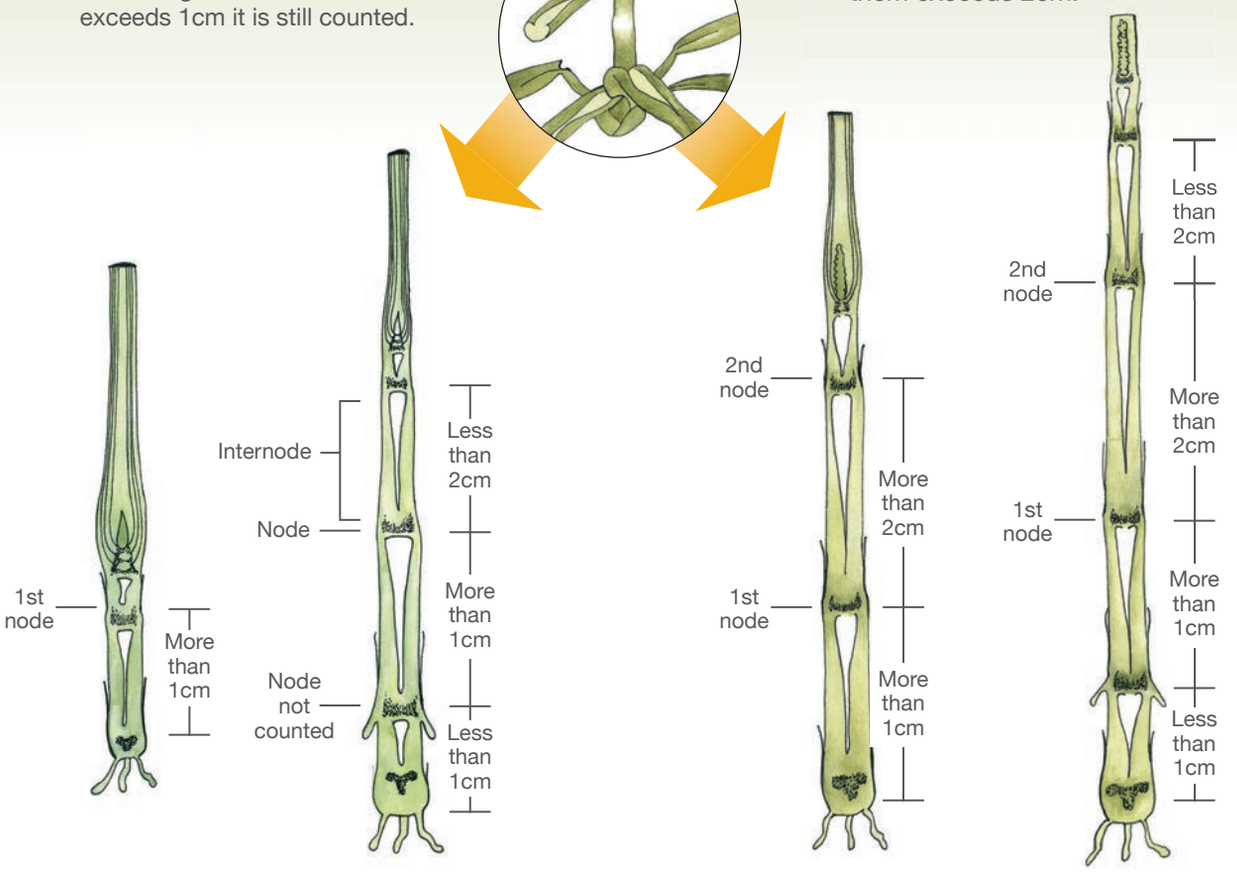
1st node detectable An internode is 1cm or more but the internode above is less than 2cm

Sometimes a node may be below the ground and may bear roots. Even if this occurs, as long as the internode below it exceeds 1cm it is still counted.

GROWTH STAGE 32

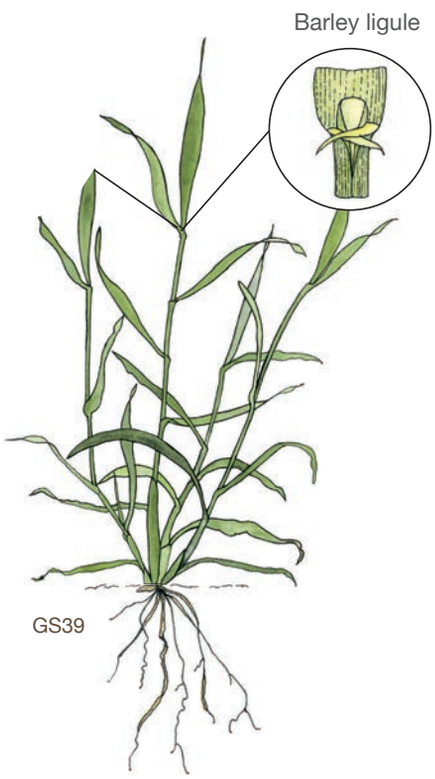
2nd node detectable

2nd and subsequent nodes counted when the internode below them exceeds 2cm.



GS21	OVERALL	SOUTH	NORTH
First node detectable	16 April	13 April	19 April
Leaf 3 emerged	15 April	15 April	15 April
Leaf 2 (Leaves emerge every 180°C days (day degrees))	25 April	24 April	27 April
GAI (Canopy increases up to 0.2 units/ day until GS39)	2.4	2.6	2.3
N Uptake (kg/ha) (About 35% of final N uptake)	65	67	63
Crop height (cm)	11	12	9
Total dry weight (t/ha) (Only 16% of final dry weight)	2.4	2.6	2.1

GS39	OVERALL	SOUTH	NORTH
Flag leaf (leaf 1) blade visible	6 May	3 May	9 May
Total leaf number (No further leaves emerge onmain shoot)	14	15	13
GAI	5.1	5.1	5.1
N Uptake (kg/ha) (Uptake now slows)	128	122	133
Crop height (cm)	45	47	42
Total dry weight (t/ha) (About 35% of final dry weight)	5.2	5.1	5.3



BOOTING

GS41 Flag leaf sheath extending
GS43 Flag leaf sheath just visibly swollen
GS45 Flag leaf sheath swollen
GS47 Flag leaf sheath opening
GS49 First awns visible

EAR EMERGENCE

GS51 First spikelet of ear just visible above flag leaf ligule
GS55 Half of ear emerged above flag leaf ligule
GS59 Ear completely emerged above flag leaf ligule

FLOWERING

GS61 Start of flowering
GS65 Flowering halfway
GS69 Flowering complete


Barley

GS59	OVERALL	SOUTH	NORTH
Ear completely emerged (also GS61 flowering starts at the end of ear emergence)	26 May	21 May	30 May
Shoots/m²	15 April	15 April	15 April
GAI (Awned ears represent 10% GAI)	5.8	5.8	5.8
N Uptake (kg/ha)	163	164	162
Crop height (cm) (Little further stem extension)	87	89	86
Total dry weight (t/ha) (About 80% of final dry weight)	9.6	9.6	9.6

MILK DEVELOPMENT

GS71 Grain watery ripe
GS73 Early milk
GS75 Medium milk
GS77 Late milk

GS77

GS71	OVERALL	SOUTH	NORTH
Grain watery recipe	8 June	5 June	11 June
GAI (Leaf loss lower in the canopy)	5.0	5.0	5.0
Crop height (cm) (No further extension occurs)	93	89	98
Stem dry weight (t/ha)	6.9	6.9	6.8

DOUGH DEVELOPMENT

G83 Early dough
GS85 Soft dough
GS87 Hard dough (thumbnail impression held)

GS85

GS87	OVERALL	SOUTH	NORTH
Hard dough	8 July	28 June	14 July
GAI	0.4	0.3	0.6
Grain filling period (days)	93	89	98
Ripening period (t/ha) (45% to 20% moisture content)	20	21	18
Total dry weight (t/ha)	15.7	15.4	16.1

RIPENING

GS91 Grain hard (difficult to divide)
GS92 Grain hard (not dented by thumbnail)
GS93 Grain loosening in daytime

GS91

HARVEST	OVERALL	SOUTH	NORTH
Total N offtake (kg/ha)	181	179	183
Shoots/m²	775	795	755
Stem weight (t/ha)	6.4	6.2	6.6
Grain weight (mg) (15% moisture content)	46	45	48
Grain specific weight (kg/HL)	65	65	65
Grain N (%)	1.73	1.80	1.73
Total dry weight (t/ha)	14.8	14.4	15.2
Grain yield (t/ha) (15% moisture content)	8.8	8.5	9.0

NOTES

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FURTHER INFORMATION

Thank you for reading the BASF Barley agronomy guide produced in collaboration with ADAS, NIAB, Teagasc and SRUC.
Please see below for further information.

BASF: www.agricentre.basf.co.uk
𝕏 @BASFCropUK

Teagasc: www.teagasc.ie
𝕏 @teagasc

NIAB: niab.com
𝕏 @niabgroup

SRUC: www.sruc.ac.uk
𝕏 @SRUC

ADAS: https://adas.co.uk
𝕏 @ADASgroup

In collaboration with

ADAS NIAB SRUC

www.agricentre.co.uk

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Use plant protection products safely. Always read the label and product information before use. For further product information including warning phrases and symbols refer to www.agricentre.basf.co.uk. For further information, please do not hesitate to contact your local Agronomy manager or the BASF Technical Services Hotline: 0845 602 2553
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