A rye resurgence?

> *A crop that requires less nitrogen, but doesn't compromise yield, is a no-brainer.*

Technical
Rotational Resilience

As growers seek out alternative cereals options, Elsoms has been investing in research and genetics to showcase just how valuable hybrid rye can be in the rotation. *CPM* finds out more.

By Charlotte Cunningham

Rye is a crop that has been around for thousands of years, and while it has always been 'good', the advances in wheat and barley breeding strategies and capabilities have often progressed at a much quicker pace, which to some extent has meant rye has been left behind.

But now, with hybrid types commercially available — teamed with a growing market and a shift in priorities when it comes to planning a rotation — rye looks like it could enjoy a huge surge in popularity over coming seasons.

Elsoms has been working with Saaten Union to deliver improvements in hybrid offerings for the UK market.

"Rye as a crop has the potential to grow in importance in the future. It's much more robust than other cereals with limited attraction to diseases and better resilience to environmental stress factors such as frost and drought," says Dr Franz-Joachim Fromme, breeding director.

"Breeding has to deliver varieties that are adapted to permanently changing growing conditions and challenges at farmer level," he adds. "There are several factors that a breeder has to keep in mind to achieve successful breeding of new varieties. Beside economic interests and the loss of current resistances, climatic change is a topic of increasing importance that has to be considered when developing new varieties."

Biotic stress factors

To look at these factors in more detail, Franz-Joachim explains that climate change is driving a greater requirement for more tolerant varieties, with that tolerance extending to drought, heavy rain and other extreme weather phenomena. "If we then look at the change in biotic stress factors, the interaction between pathogen virulence and plant resistance changes natural plant pest populations dynamically over the years. This results in broken and lost resistances.

"Therefore, breeders have to identify and introgress new sources of resistance to reduce the propagation of pathogens and yield-impacting damage to crops."

If the use of chemical plant protection is increasingly restricted, resistant varieties will play an even more important role in successful pest management strategies, he adds. "Additionally, a potential ban of growth regulators would impact yield-security of current cereal-varieties tremendously, resulting in a high risk of lodging canopies in critical years.

"On the other hand, modern high yielding varieties present bigger and heavier ears which also interferes with the standing power of the crop. The introduction of dwarf-genes (semi-dwarf-varieties) may be a step change to combine lodging tolerance and high yield."

Then there is the economic side of things. "Varieties with better yield and improved yield-supporting traits enable farmers to get higher output with the same input — or reduce input for the same output. Exceptionally good varieties are characterised by exhibiting a constant, high yield level throughout several years."

A well-managed germplasm is essential for all genetic improvement, and this is especially true in hybrid breeding where the ▸

Rye has the potential to grow in importance in future, says Dr Franz-Joachim Fromme.

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AGRONOMY INSIGHTS

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Winter wheat and barley crops are currently at a wide range of growth stages following a relatively dry and cool April with some late frosts. Fertiliser programmes have now been completed for many feed wheat and barley crops, however, dry and cool weather has limited uptake of nitrogen in some of these fields.

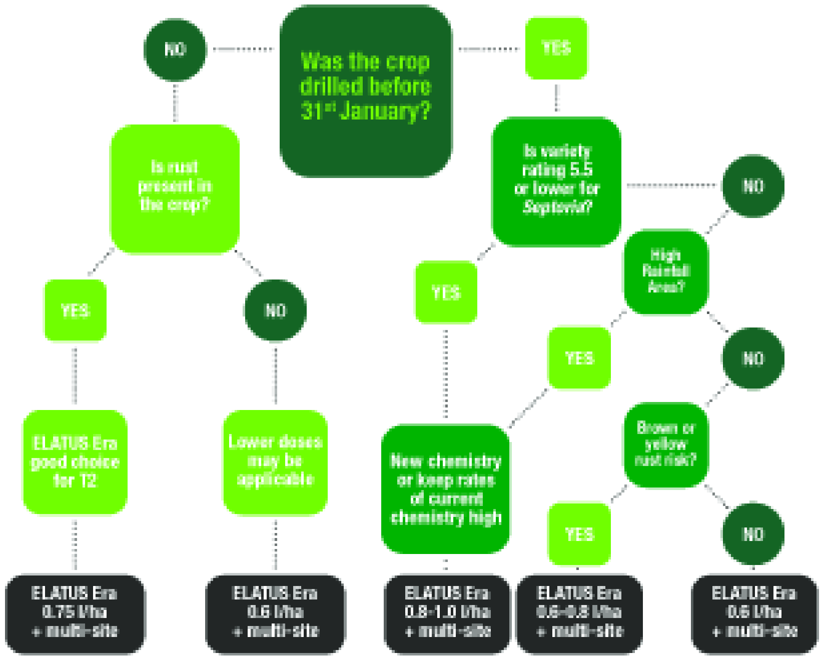
Many wheat and barley crops are suffering from stress and are shorter than normal, with disease continuing to affect the lower leaves.

Below are the key agronomy tips for feed wheat varieties and hybrid winter barley right now from Syngenta.

KEY AGRONOMY FOR WHEAT

- T2 is the key fungicide timing in wheat for protecting the flag leaf which has the highest yield building potential.
- Monitor disease levels in crops and adjust fungicide programmes according to variety, drill date, local risk, and disease pressure.
- Apply appropriate fungicides, typically SDHI/triazole-based products such as ELATUS Era (if not already used at T1), together with a multi-site like folpet at T2 to control disease and protect fresh growth after application.
- **Growth regulation:** trials and experience has shown that a programmed approach is the best way to reduce lodging risk in varieties which are more prone.
- An ethephon-based T2 application will be beneficial for height reduction, in turn reducing the centre of gravity of the crop.
- Limited rainfall and high diurnal temperatures have resulted in crop stress. Assess the requirement for late season growth regulation. Reduce the rates of ethephon-based growth regulators at the GS37-39 timing if crops are stressed to avoid over-regulation.

Use the following T2 decision tree for best use of ELATUS Era if it has not been used already in the fungicide programme.



Consult a BASIS qualified advisor for specific advice for each field.

KEY AGRONOMY FOR HYBRID BARLEY

- Growth regulation: experience has shown that a programmed approach is the best way to reduce lodging risk in varieties which are more prone.
- Be aware that crops have typically reached only half of their final height by GS39 and that hybrid barley varieties are typically taller than conventional varieties.
- Check for crop stress, especially if conditions are dry, and assess the requirement for late season growth regulation. Consider digging down into the soil to establish if the roots are still in moisture.
- Reduce the rates of ethephon-based growth regulators at the GS37-39 timing if crops are stressed.
- Monitor disease levels in crops and adjust fungicide programmes according to local risk, variety, and disease pressure. T2 is the key timing for *Ramularia* control.
- Apply appropriate fungicides at T2 to control disease and to protect fresh growth after application, for example, ELATUS Era (if not already used at T1) together with a multi-site like folpet to enhance *Ramularia* protection.

USE A ROBUST FUNGICIDE PROGRAMME AT T1 & T2

Timing	Target	More rust-resistant SY Kingston, SY Thunderbolt, Belfry, SY Armadillo, Libra	Less rust-resistant Belmont, SY Kingsbarn, Bazooka, SY Baracooda
T1 (GS31-32)	Keep lower leaves green and keep out disease	SDHI/PTZ/strobe/cyprodinil	ELATUS Era 0.5-0.6 l/ha
T2 (GS37-39)	Drive final yield & specific weight. Reduced brackling	ELATUS Era 0.5-0.7 l/ha + folpet 1.0 l/ha	PTZ/SDHI + folpet 1.0 l/ha

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Note: Adjust inputs according to LOCAL risk and disease. Folpet offers resistance management benefits. PTZ = prothioconazole

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For a long time, the rye market has been a bit of a closed shop, says Andrew Creasy.

▸ breeding progress depends on quality and improvement of in-house germplasm in the parent-pools, adds Franz-Joachim. "Hybrid breeding is significantly different to conventional line-breeding programmes. In hybrid breeding, adapting breeding progress from other companies is reduced to simple inherited single traits.

"Close contact to the market and farmers is also important to identify needs and challenges next to the obvious big breeding goals. Breeding has to anticipate future needs due to changes and prepare in advance."

Looking at some of the new genetics coming through from SU lines, and there is a particular focus on semi-dwarfs — due to the taller nature of rye — as well as ergot reduction through pollen performance.

Unpollinated rye flowers

"Pollen acts in competition to ergot spores that can cause an infection of unpollinated rye-flowers. A high amount of pollen therefore provides indirect protection against this disease," says Franz-Joachim. "Besides the existing pipeline of high yielding varieties with mixed in pollen-providers, we are developing high pollen producers for high ergot-risk locations to offer farmers a broad portfolio to choose from. The first varieties of the new type were applied in Germany last year, and will soon be introduced into the market."

With growers wary of rye's tall growth habit, they are also working on semi-dwarf hybrids to combine high yield with robust standing power and the first prototypes are now in the pipeline, he adds.

Rather than creating multi-purpose varieties, Elsoms has been focusing on how individual varieties can fit into specific situations, says Henrietta Wells.

"In addition to ergot, semi-dwarfs and yield, the maintenance and improvement of existing resistances and frost tolerance forms a major part in our breeding process."

Thinking about markets, and it's fair to say that options have traditionally been fairly limited for growers, says Andrew Creasy, product manager at Saaten Union. But now,

Key varieties at a glance

Rather than creating multi-purpose varieties, Elsoms has been focusing on how individual varieties can fit into specific situations, explains Henrietta Wells, energy, forage, and hybrid cereals crop manager at Elsoms. "We have seen a big increase in the popularity of rye over the past couple of years. Being a hybrid crop, it fits well in every situation, adds flexibility to the rotation and has some promising end market outlets.

"On top of this, the agronomics are just getting better and better, proving the real value of including rye in the rotation."

Henrietta says that there are four key varieties for Elsoms this season: SU Performer and SU Arvid, as well as candidate varieties SU Pluralis and SU Bendix.

"SU Performer is our biggest selling variety — first registered in 2017 — and delivers consistent performance throughout, making it a really safe choice for either grain or wholecrop growers.

"Fellow Descriptive List mate, SU Arvid is now in its second commercial year, and with this variety we're really looking to target the wholecrop market. This is largely due to Arvid's really high methane percentage, high silage weight and really good brown rust resistance."

And over on the 2021/22 Candidate List, SU Pluralis is so far showing promising results, she adds. "Pluralis is a third-year candidate and from what we've seen so far looks like it has excellent brown rust resistance. This variety is going to be targeted predominately at the Scottish market as it has some really good lodging scores. Also, it's quite early maturing, so it could be wholecropped if farmers were looking for something with a little more flexibility to spread the workload.

"Bendix is the sister of Pluralis and with the best nitrogen-to-protein conversion rate — teamed with good standing ability and brown rust resistance — it's a great option for those looking to grow for the grain market."

Among other work, Elsoms are also conducting biogas and forage trials this year and from a commercial point of few, Henrietta says this is to ensure each variety is assessed thoroughly to find its most suitable place in the market. "Our goal is not to release a long list of multi-purpose varieties, but instead, we're more focused on finding exactly where it'll fit and what situation is going to be suited to each variety. We've got some really good trials at the moment and are looking at some very specific assessment points to ensure we can be confident in our recommendations."

	Yield (% treated controls)		Grain quality			Agronomy			Disease
	Fungicide-treated	Number of trials	Protein content (%)	Hagberg falling number	Specific weight (kg/hl)	Lodging (%)	Straw weight (kg/hl)	Ripening days (+/- SU Mephisto)	Brown rust
SU Performer	106	13	9.7	258	78.4	[5]	127	+1	4
SU Arvid	104	8	9.5	209	77.7	-	134	+1	4
SU Cossani	101	13	9.8	240	77.5	[16]	127	0	4
SU Mephisto	100	13	9.8	223	77.3	[20]	128	0	3
SU Nasri	99	8	10	220	77		126	+1	3
DL Candidates									
SU Baresi	108	6	9	245	78.8	-	[125]	[1]	-
SU Pluralis	105	6	9.3	220	77.9	-	[125]	[0]	-
SU Elrond	105	6	9.7	238	80.2	-	[130]	[0]	-
SU Bendix	104	6	10.2	227	78.5	-	[130]	[1]	-

Source: AHDB Descriptive List for winter rye 2021/22; [ ] - limited data

Rye for AD and wholecrop has helped boost the national area.

thanks to new opportunities and research into the value of rye for grain production, there's a much more buoyant outlook.

"For a long time, the rye market has been a bit of a closed shop. The one market that has sat in the middle of all production has been Ryvita, and that's about it. However, things are changing.

"When AD and wholecrop rye came along it boosted the national area massively, and now with more and more growers able to see how good it can be — subsequently increasing demand — it's opening up new avenues for the crop."

Aside from new marketing opportunities,

Rye does particularly well on lighter land and has a much lower nitrogen requirement than wheat.

Mapping of the genome

Recently, two complete annotated genome sequences of two rye lines have been published in *Nature Genetics*, and according to Franz-Joachim, this is a step change for using markers in rye breeding. "We're working intensively to combine existing breeding knowledge and experience with these new tools to manage our germplasm and to select and trace genetics behind important traits.

"This enables us to use our breeding resources more efficiently, potentially reduces breeding time and further improves our germplasm management. It could also support us to identify valuable new variation outside the existing elite gene pool. Good phenotyping by an experienced team of breeders is still essential for marker development."

rye boasts a stack of attractive characteristics which could help give it an edge over other more widely grown cereals. "At our Cowlinge site, second wheats grow really well but what we have found is that when you drop off onto lighter soils it doesn't have the same performance.

"However, rye seems to overcome this — making it a great option for those who struggle to push yields on lighter land. "Agronomically, it just makes sense, and we think this is largely due to how robust rye is — in terms of drought resistance etc — compared with crops like wheat and barley."

As well as this, rye seems to do a lot of its growing early on, which is great for weed suppression too, adds Andrew. "From what we've seen of it, blackgrass can't compete as quickly as rye does. Of course, that doesn't mean that it's a silver bullet. But if you're rethinking your rotations from a weed control perspective, then this will certainly help."

And there are benefits from an environmental standpoint, too. "Looking at nitrogen requirements, rye needs much less than wheat, which at a time when there's increased pressure on growers to reduce nitrogen applications, this can only be a good thing. For those growing rye for an AD market, this reduction could bring total application under 100kgN/ha.

"In my view, a crop that requires less N, but doesn't compromise yield, is a no-brainer."

From an end-user point of view, this could also drive market potential, he adds. "If we look right to the end of the chain, a crop that's producing decent yields with less N is going to tick a lot of boxes for end users who have a huge focus on producing more 'environmentally-friendly' food.

"The sector leading this at the moment is

SU Pluralis is a third-year candidate which looks as though it has strong brown rust resistance.

pigs, with a growing interest in the value rye grain has as a pig feed source."

On-going trial work includeslooking at seed dressings, adds Andrew. "Fundamentally, this is observing how a cocktail of nutrients do — or don't — aid the growing of rye, and this autumn, we'll be looking to add biostimulants into the mix too. Again, this all comes back to thinking about that end market and what their priorities and initiatives are. Anything we can do to reduce the need for huge doses of chemistry only makes the crop more attractive." ■

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Rotational resilience

Less oilseed rape, spring cropping, a focus on improving soil health and building carbon all rely on a cropping rotation that is resilient. Each crop must deliver a profit on the year while the rotation as a whole should ensure the farming business remains sustainable for years to come.

In this series, *CPM* partners with Elsoms to look at the opportunities offered by cereals other than wheat and delves into the genetics behind them. Through privileged access to the company's staff and resources, these articles explore rotations that secure a reliable return today and offer bright prospects for the future.

Elsoms Seeds is the UK's leading independent seed specialist and plant breeder. The company's experienced, specialist staff combine a passion for high quality vegetable and agricultural seed with the latest in plant-breeding research and seed technology. This ensures a focus on high performance and low-risk varieties, building resilience into rotations for years to come.

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