> *We have to live with pathogens – rather than seek to defeat them with chemistry or genetics we should encourage a diversity of beneficial microbes that outcompete them.*

Technical
Regenerative agriculture

Biology comes first

For the regenerative agriculture grower, the question this autumn is not so much which wheat variety is the most resilient, but how resilient is the system it'll be placed in. *CPM* assesses the priorities.

By Tom Allen-Stevens

For those committed to regenerative agriculture, looking for their soils and their farming system to naturally complement the potential of their crop, variety choice may not be as simple as picking out a few key criteria from the AHDB Recommended Lists.

Top-line yield may be pushed down the priority list in favour of disease resistance, or lodging scores. The more analytical grower may put their requirements through the AHDB Variety Selection tool that weighs agronomic merit against yield, or look for information on aspects such as grassweed competitiveness from the likes of Agrii's Advisory Lists.

But even these resources may be offering little more than a simplistic way to find a truly regenerative wheat, believes independent breeder Bill Angus. "What you find on the RL and in commercial breeders' lines only just scratches the surface of the genetic variability wheats can deliver," he says.

"That's not to say there aren't some traits worth picking out, but there's so much more potential and diversity we can build into our wheats. There's also currently a naivety around certain genetic traits to deliver resilience when this could actually result in more serious agronomic issues."

High resistance scores

Here he points to the varieties on the RL brandishing high scores for resistance to *Septoria tritici*. "It's a great achievement for breeders to have so many high-yielding varieties with good disease scores. But many of these have Cougar in their parentage — eight of the ten soft wheats to have been added in the past three years, including all the new Group 3 varieties. AHDB research published in 2019 suggests this resistance was broken in 2015."

Bill's concerned that this is a heavy reliance on one source of genetic resistance. If it transfers into the national wheat area, this may cause it to break down as septoria evolves to sidestep the genetic barrier, resulting in more aggressive populations of the disease. "We've seen this with yellow rust — it's sometimes better to go for a variety with good background resistance, so a lower overall score, but one you can rely on. The key aspect, though, is to look at the parentage, rather than just the disease ratings."

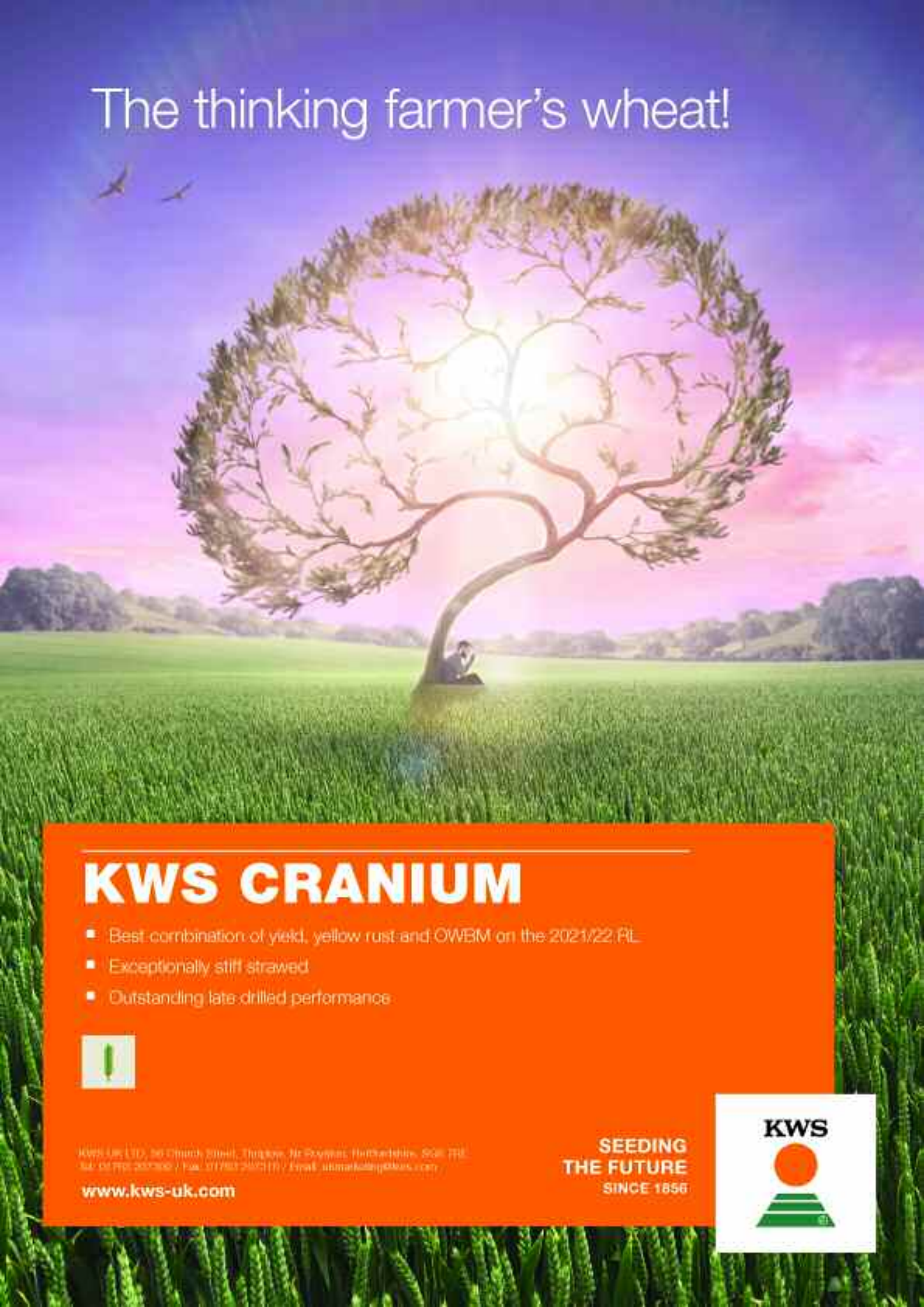
The "huge opportunity" for wheat breeding comes in what Bill calls 'agronomising genetics'. "Hybrid wheat has the potential to transform how we grow the crop, and draws on the sorts of genetic resources that could have a huge impact for farming."

He points to the involvement of the large agrochemical companies — both BASF and Syngenta have developed programmes with varieties expected for commercial release in the mid 2020s. Just recently Bayer and RAGT announced a joint venture to develop hybrid wheat.

"The ag-chem companies bring with them massive global resources and the potential to truly exploit a wide pool of genetics that currently commercial breeders simply can't justify. Hybrid wheat won't necessarily improve crop grain yields on the best soils, but it can offer more resilience and opportunities to improve the agronomy in this area as well as on second-rate and more marginal land."

So what can the regenerative agriculture enthusiast do now? "Firstly, do your own ▸

Bill Angus believes that what you find on the RL only just scratches the surface of the genetic variability wheats can deliver.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Bill Angus' top RL tips for the regen ag grower

It's a tricky balance for the regenerative agriculture grower to find wheats with enough resilience without relying too heavily on their genetics. *CPM* asked Bill to pick out his favoured front-runners.

Group 1 – Crusoe (Cordiale x Gulliver) It's the one variety on the RL that millers have to use to make bread. With good septoria resistance and high protein, the genetics originate from the *dicoccoides* subspecies, that's still rare in UK lines, and it's the longest-serving variety on the RL, so is unlikely to throw up any surprises.

Group 2 – KWS Siskin (KWS Sterling x CPBT W134) While growers on more fertile sites and heavier land will want to avoid it, Siskin has good septoria resistance and no other major disease weaknesses. Although you can say the same of KWS Extase (Boisseau x Solheio), the high projected area of this variety carries with it a basket of risk in terms of dependence on one set of genetics, and it's susceptible to eyespot.

Group 3 – KWS Barrel (Bantam x Viscount) Yes, Barrel. Though probably best for growers in the North. It has a low score for septoria but you know where you are with it, and it performs consistently. Southern growers and those who want to try one of the new lines could go for LG Astronomer ((Cougar x Leeds) x Britannia).

Group 4 soft – LG Skyscraper ((Cassius x NAWW 29) x KWS Santiago) Top of the Group 4 lines and incredibly consistent, the variety leans on a different set of genetics to other popular wheats. RGT Saki (Cougar x KWS Santiago) looks interesting, but if its septoria resistance wavers, so too will its yield potential.

Group 4 hard – Graham (Premio x Expert), Costello (CPBTW151 x CPBT W134), Theodore (Stigg x Tuxedo) The ultimate blend for the discerning regen ag grower and a complementary trio of genetics. Graham is probably the best all-rounder. Costello brings its consistency and impressive specific weight. This balances Theodore's major weakness, but it has the valuable septoria resistance from its *dicoccoides* parentage.

Many of the new varieties on the RL have Cougar in their parentage.

▸ on-farm trials — work out what varieties work best for you in your own situation and assess overall return, rather than just yield. Secondly, look beyond the headline RL figures and seek to bring in a basket of diverse traits — it's essential to know the parentage of the wheats you grow. A blend of varieties, especially for the feed grower, is a very good option here.

"Finally, don't take your foot off the disease-control pedal — there is a synergy between modern varieties and the chemistry we use on them. Rely too heavily on the genetics and major pathogens will quickly evolve."

While foliar diseases dominate the thinking here, Bill cautions growers to bear in mind the impact their wheat choice has on soil-borne pathogens. "We know from take-all research that you can upset the soil fungal balance by growing a variety that is susceptible as a first wheat, leading to problems with the subsequent crop," he explains.

"It's an area we're just beginning to understand, but maybe the greatest influence on resilience a regenerative grower can have is to develop the soil biology through their cropping, cultivation and varietal choice. We have to live with

As with yellow rust, it's sometimes better to go for a variety with good background disease resistance that's less likely to break down.

Gentle nudge for carbon credits

Arable farmers interested in receiving income for carbon offsetting through a new farmer-led initiative have until the end of May to register their interest.

Gentle Farming, started by fourth generation Lincs farmer, Thomas Gent, is an online platform which he claims is the first in the UK to offer growers fully verified carbon-trading certificates. Operated via European soil carbon certification program, Commodicarbon, income for farmers following regenerative practices can typically be in the region of £60-90/ha and may be as high as £150/ha for those sequestering 5t/ha CO_2e.

"The way it works is that each certificate issued by Commodicarbon represents 1t CO_2e sequestered by a farmer in their soil. Each certificate is uniquely identifiable, and can be tracked to the specific field," says Thomas.

He recommends growers enrolling for the scheme do so with the help of a qualified agronomist. Details of the production system entered on the online platform include tillage practices, handling of straw and residues, fertiliser data, fuel use and post-crop practice for each field registered. Once measurements are verified, blockchain-secure certificates are issued and payments made after harvest.

"As an example, inputting 50ha for the first time may take around 30mins and could yield 150t of carbon, worth a projected £25-30/t after costs," says Thomas who claims strong relationships with a range of carbon buyers.

"We market these credits as a means to invest in regenerative agriculture, demonstrating the clear biodiversity, water quality and community benefits of this farming system. In the future we plan to link the sale of additional produce from the farm under a regenerative farming brand," he adds.

Income from carbon trading for farmers following regenerative practices can typically be in the region of £60-90/ha, says Thomas Gent.

The introductory cost to participate in the initiative is £43/month for which you get 80% of the carbon sales price.
www.gentle-farming.co.uk

pathogens — rather than seek to defeat them with chemistry or genetics we should encourage a diversity of beneficial microbes that outcompete them," notes Bill.

This is exactly what Simon Cowell has been aiming to do across the 160ha of arable cropping he has at Motts Farm, near Southminster, Essex. The heavy clay soils have been direct drilled for the past 17 years, currently with either a Simtech Aitchison (tine) or Moore Unidrill (disc).

In recent years, he's developed an interest in arbuscular mycorrhizal fungi (AMF). Current understanding is that the AMF hyphae form a symbiotic relationship with plant roots, extending the effective 'root' surface area by 100-1000 times.

As well as improving soil structure and supporting healthy plant growth, AMF can alleviate stress, help drought tolerance and degrade pollutants. Research suggests that in the presence of AMF, plants will get the fungi to do all the work on processing phosphate, and can even do the same for nitrogen and zinc, to a certain point.

"We've been carrying out tests to gauge the AMF content of our soils — there's a standard test available," Simon explains. "We're also doing wheat variety trials to see how they perform in a no-till situation."

Soil disturbance is known to have the biggest destructive effect on AMF, while continuous crop cover will encourage them. But they don't like brassicae, such as oilseed rape and mustard, and this can actually drive down the fungal community.

"30% colonisation of AMF is reckoned to be pretty good," continues Simon. "You can influence this through your cropping with legumes being particularly beneficial and perennial crops, such as grass and lucerne, boosting the balance. We haven't grown OSR for 12 years and found through our trials that different wheat varieties also have an influence."

While the variance between lowest and highest here is as much as 20%, Simon stresses that the content of AMF in his soils averages a relatively high 70%, and that each farm will have its own unique population. "It's the system, not the genetics that has the biggest influence on AMF," he says.

"Take-all susceptible varieties or practices that encourage the pathogen will compete with AMF — it quickly grows long thin hyphae, while AMF is shorter and slower growing. An AMF content that's nurtured is much stronger, however, and will out-compete pathogens — I can't remember the last time we had problems with a soil-borne disease and never have to treat for them, while wheat seems much more resilient to yellow rust and we often miss out a fungicide spray altogether. Growing variety blends helps here, too.

"I don't think AMF will boost yield, but you do get a healthier plant, which boosts overall return. There's so much more to learn, though, so who knows what potential there could be?" ■

You can upset the soil fungal balance by growing a variety that is susceptible to take-all as a first wheat, affecting the subsequent crop.

The massive resources ag-chem companies can bring to hybrid wheat have the potential to transform how the crop is grown.