

# Agronomising genetics

“It’s about taking ‘genetics’ (varieties) and providing detailed agronomic advice.”

## Technical Innovation Insight

Could a closer relationship between grower and breeder be the key to achieving the genetic potential of varieties? *CPM* takes a closer look at an initiative that aims to do just that.

By Lucy de la Pasture

As combines move throughout the country, thoughts will be turning towards the new season and winter cereal variety choice in particular. With wheat likely to be the main focus of attention, growers are particularly vulnerable to recent changes in rust and septoria populations and the havoc that’s been wreaked on several varieties.

The AHDB Recommended List (RL) is the first port of call for most growers, but the information it contains will not be up-to-date or relevant for some autumn 2021 variety choices, says independent UK wheat breeder, Bill Angus of Angus Wheat Consultants (AWC) and F1 Seed.

“The decision about which variety to grow is the most important one in the farming year — get this wrong and you could be tied into some serious expenditure

when it comes to combating disease,” he says.

The warning signs have been there for some time, says Bill, but 2020 and 2021 have seen very significant changes in disease races and populations, resulting in many highly disease-susceptible varieties with disease resistance ratings which are no longer reliable, he highlights.

### Variety pedigrees

“For years people have been talking about spreading the risk by choosing varieties with different genetic backgrounds. Digging deep into variety pedigrees will help achieve this because there are currently a large number of available varieties which depend on a narrow source of genetic resistance,” he explains.

The problem has been dramatically illustrated this season with several newer varieties, which are highly rated for septoria resistance, which have broken down spectacularly to the disease. All have Cougar genetics in their lineage. It’s a similar story with yellow rust, where Hereford in the parentage should also be a red flag, says Bill.

“There are eight varieties with Cougar parentage on the RL and three with Hereford, so grower research is critical. Unfortunately pedigree information is now no longer published on the RL (the last time it featured was in 1988) but never has

there been a more compelling argument to reinstate this feature. Being able to choose varieties from different genetic groups is the first step to adding security for growers.”

Understanding the genetic strengths and weaknesses of varieties and looking after them accordingly is fundamental agronomy, believes Bill, but with wheat seed usually sold without any information to support this approach, it’s inevitable that some varieties are doomed to failure.

With that in mind Bill has launched an initiative, ‘Agronomising Genetics’, to help growers fulfill the genetic potential of varieties. “It’s about taking ‘genetics’



F1 Seed’s breeding strategy aims to break the ‘boom and bust’ cycle that has been around for over sixty years, explains Bill Angus.

(varieties) and providing agronomic support through detailed agronomic advice. These are not blue-prints — just added information and experiences which relate to where varieties would be best suited (and where not) and using this information with the growers' own experiences to produce sustainable outputs.

## Favourable comments

"We're focusing our Agronomising Genetics approach on our new winter wheat variety, Garibaldi. A number of progressive growers are testing this variety out, with very favourable comments so far. The feedback from these growers, aligned with our own agronomy trials, will form the basis of an increased information flow to new growers of the variety."

Bill is keen to point out that the yields portrayed on the RL are a reflection of a very robust fungicide programme that's designed to reduce disease pressure to zero.

"This gives a measure of yield potential but then it's down to agronomists and growers to optimise their inputs to try and reach their targets for yield and quality. Septoria control will be challenged in 2021/22 but, interestingly, the varieties with medium to good septoria resistance — which is based on multi-gene resistance — are likely to be safer havens than some of the higher-rated varieties, which are usually dependent on major resistance genes. Garibaldi fits into the 'medium to good' category which means it's not dependent on major gene resistances."

Tailoring agronomy means matching inputs to variety traits and not necessarily reducing inputs per se. Bill is firmly of the opinion that low inputs are likely to lead to low outputs and instead advocates targeted inputs as part of the Agronomising Genetics strategy.

"It's already clear from historical as well



*F1 Seed is working with wheat breeder CIMMYT in Mexico to introduce more durable adult plant resistance genes.*

as current data that inputs need to be sustained. For the longer term, with limited global resources of wheat disease resistance, there's a necessity to conserve these valuable resistances using this approach," he says.

To that end F1 Seed is working with the International Maize and Wheat Improvement Center (CIMMYT) in Mexico, which is the largest publicly funded global wheat breeder.

"We're looking to introduce higher levels of adult plant resistance (APR) into UK varieties," says Bill. "The aim is to break the 'boom and bust' cycle that has been around for over sixty years. The UK problem of optimising the use of genetic resources is also important from a wider global perspective. The mission of CIMMYT, which is part-funded by the ▶



*Felix Austin explains that resistance to yellow rust relies on a rapidly shrinking genetic base.*

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*Varietal ratings for yellow rust resistance are being challenged because of the ease with which the pathogen can overcome major resistance genes.*

► UK Foreign Commonwealth and Development office (FCDO), is focused on this multi-disciplinary approach.”

Director General of CIMMYT, Martin Kropff, believes that it's essential for better genetics to be put together with improved agronomy and crop management to support the transformation of AgriFood systems into affordable, sufficient and healthy diets, which are produced within planetary boundaries.

“CIMMYT and the Consultative Group on International Agricultural Research

(CGIAR) appreciates the support from FCDO to wheat research from better genetics, which includes biofortification with Zn, heat tolerance, disease resistance (particularly for the rusts), to better crop management in developing countries where people on less than \$2 per day (£1.46) rely on wheat products as the basis of their daily diet.”

This collaboration with CIMMYT is particularly significant because the yellow rust situation in the UK is precarious, believes Felix Austin, wheat breeder at AWC.

## Boom and bust

“Resistance to the disease relies on a rapidly shrinking genetic base. We have seen the speed of the boom-and-bust cycle increase to the point where new varieties are succumbing, or have already succumbed, to yellow rust by the time they reach the market.

“Through our collaboration with CIMMYT and the John Innes Centre we aim to change this. We are focusing on APR, the additive impact of many small effect genes, rather than relying on one major gene to find yellow rust resistance. This is a much more durable approach as it doesn't rely on a single resistance gene, which can become a weak link in the variety's armour.”



*Martin Kropff believes it's essential for better genetics to be put together with improved agronomy and crop management.*

The outcome of this global approach will be reciprocal, adds Felix. “We're searching for this resistance in both UK and CIMMYT (Mexican) germplasm. This means that we can increase the genetic diversity in elite UK lines and transfer any resistance found in UK material to CIMMYT to aid their efforts in the developing world.”

As the world moves towards more sustainable systems of agriculture in the effort to tackle climate change, Bill is certain that agronomy will be changing.

“Already we've seen a move towards

## An insight into breeders' thought processes

One grower who is making good use of having a closer than traditional relationship with the breeder is Charles Mathieson, who farms 180ha near Bury St Edmunds in Suffolk. He currently has a seed crop of Garibaldi in the ground after being impressed with the variety's performance on the farm last harvest.

His ground is predominantly a sandy clay loam, with areas which fall on both the heavier and lighter side. Over the years Charles has got on top of his blackgrass population and describes it now as 'manageable with a fairly light touch' after adopting a zero-tolerance approach. This has enabled him to return to a predominantly autumn planted rotation of winter wheat, winter barley, OSR or beans — with spring crops slotted back in if there are any signs of blackgrass gaining the upper hand.

“Over the years I've worked closely with Limagrain and Angus Wheat Consultants. By being in the field with two plant breeders, I've come to understand where they're coming from when making decisions.”

These associations have sparked an interest in the genetic lineages of varieties and it's something

that Charles pays attention to when he's selecting varieties.

“The parentage gives me a good indication of where problems may arise and it's information that should be made much more accessible to growers. The system of averaging disease resistance rating used in the RL isn't really helpful. In my experience, if you get an oil leak then it usually just gets worse.”

Part of the insight from AWC that Charles really appreciates is the breeder information on seed rates — which are often lower than common practice. A breeder's understanding of the genetics means that he feels in a better position to give the variety the best chance of achieving its potential from the outset.

All the talk is of septoria this year, and Charles is pretty pleased with his Garibaldi, which he says has stayed much cleaner than the LG Skyscraper on the farm.

“Crops look to have good potential this year, though fusarium ear blight is more obvious than it has been for a few years. The Garibaldi does have some septoria on the lower leaves, but the flag leaf is still green and clean. Even though we used



*Charles Mathieson believes a breeder's understanding of the genetics leads to agronomy advice which gives the variety the best chance of achieving its potential.*

Revystar (fluxapyroxad+ mefentrifluconazole) at T2, it was wet and windy at the optimum timing so we weren't able to get the fungicide on until a couple of days later than intended, which may be why we haven't kept the septoria out completely.

“The input I've had so far from AWC has been really positive and it's a slightly different thought process, with a lot of attention to detail. Bill can be forthright with his statements but he backs them up with years of experience and knowledge.”



Varieties with medium-good resistance to septoria, such as Garibaldi, are less likely to suffer a breakdown in field performance.

min-till, though this may have unintended consequences in terms of disease carry over. Going forward, high quality seed should be the starting point in agronomy strategies, and this can be supported by proven seed treatment technologies," he says.

Recognising the intimate connection between agronomy and varieties, Unium have worked very closely with F1 Seed to learn more about how biology and biostimulants can support and optimise genetic potential, says the company's director John Haywood.

"Over the past three years, we've done numerous trials on Garibaldi and have seen very high and consistent yields, especially when the crop is treated with Tiros — our biological seed treatment."

### Innovation Insight

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Tiros contains bacterial endophytes which fix atmospheric nitrogen and solubilise phosphate, thereby aiding nutrient acquisition. This helps plants get out of the ground quickly and sustain them throughout the life of the crop, he explains.

### New technologies

"New seed treatment technologies, such as Tiros, can really help growers get the most out of nutrition — both applied and present in the soil. Nitrogen management is key to a successful crop and trials are showing that endophytes can play a key role in optimising nitrogen use efficiency of crops," adds John.

Pressure is growing to reduce nitrogen applications, adds Bill. "As nitrogen is the driver for both grain output and protein content, there's a necessity to be more shrewd about when, rather than how, it's applied.

"Although growers shy away from later applications (fearing protracted dry periods), wheat has enormous plasticity and is unlikely to suffer if first nitrogen applications are delayed until April (for first wheats). This later timing will reduce the threat of leaching into water courses in the higher rainfall winter/ spring months. Practical measures such as this can also help conserve nitrogen, which is critical for high yields." ■



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