A storm is brewing

> *"I think there is a naivety that we can continue to produce high yields and yet reduce inputs very significantly."*

Technical Innovation Insight

How can wheat growers use past experience to manage crops better, so they cut risks, meet environmental obligations and produce high yields of good quality grain? *CPM* relays some timely insights.

By Charles Abel

Wheat growers could face a 'perfect storm' in 2022 as government policies, rising input costs, shifting agronomy, changing pathogens and the volatile climate all combine to put unprecedented pressure on crops.

"It could challenge some of our widely accepted views on wheat growing," believes independent wheat breeder Bill Angus of Angus Wheat Consultants. "Fighting back will demand a fresh focus on agronomic practices, harnessing all we can from decades of experience." Input cuts and disease pressures are a particular concern.

"We do need to be more conscious of the environmental consequences of all our actions, but food production seems to have slipped down the agenda, despite over 800,000 people globally going to bed hungry — a figure little changed in 20 years," he says.

"That frustrates me when we have one of the best environments for growing wheat — the number one crop for food security — and the world's best and most innovative farmers."

Bill has been breeding wheat for forty years and brings an international perspective as a board member of CIMMYT — the planet's largest publicly funded wheat breeder — with a brief to breed new varieties for 200 million hectares.

"I think there is a naivety out there that somehow we can continue to produce high yields and yet reduce inputs very significantly. I worry when I see growers saying, that because of the high cost of ammonium nitrate, they will reduce applications. There is scope for some reductions, but these will be limited."

He urges growers and advisers to review output values against input costs. "The cost:benefit ratio will have changed, but growers should not just react without detailed examination of the consequences."

Nitrogen use efficiency

"There is a lot of hype about increasing nitrogen use efficiency through variety selection, but breeders have been doing that for 30-40 years. Nitrogen use has not risen but yields have. Yes there is some scope for further improvement, but it will be hard work and long term. What we need to concentrate on now is crop nutrition as a whole."

The challenges of fertiliser cost, environmental protection and optimising soil health are recognised by John Haywood of Unium Bioscience. "Bill and I trialled a range of techniques looking at nutrient use efficiency, in particular nitrogen, over the past four years, with a great deal of success," he says.

Enhancing the biological supply of nitrogen through the use of endophytic bacteria in Tiros seed treatment and Tarbis foliar application are two options. So too is the choice of nitrogen fertiliser, as granule or liquid, with or without polymer coatings/additions of metabolites to aid the assimilation of supplied nitrogen, as in Twoxo XL, he notes.

"When combined these approaches can dramatically alter nutrient use efficiency, so you can produce the same with less applied nitrogen."

A greater threat to profitability in 2022 is disease, Bill contends. "The AHDB Recommended List has evolved over the years, but the high input/high output testing regime is largely unchanged since the 1980s. Trials are grown with very high fungicide rates, costing around £260/ha, ▸

Input cost:benefit ratios may have changed – but review output values against input costs before reacting, urges Bill Angus of Angus Wheat Consultants.

In 2021, across different varietal genetics, there was a clear benefit from the latest chemistry, says BASF's Jon Helliwell.

▸ to measure full yield potential. Growers and agronomists must then work out how to extract as much of that yield potential as possible using on-farm experience."

But varieties have nuances and growers need more detail from breeders and agronomy support businesses, delivered through a smarter and more appropriate testing regime, he argues.

"Within our own business we look at a range of inputs and start agronomy work early in the variety's life cycle," he says. That practice needs adopting more widely, hence AWC's concept of 'Agronomising Genetics' (now registered as a trademark) to fill the gap (*CPM* Aug 2021).

The two major wheat diseases — septoria and yellow rust — pose particular threats to the current UK variety portfolio, he believes, with septoria the greater concern.

Breeders have successfully produced varieties with higher levels of resistance by stacking minor genes over time. But more recently major genes have been deployed, bringing very significant improvements in resistance, but also an inherent fragility.

Cougar resistance

The Cougar-based resistance is a prime example. "The inevitable and highly predictable demise of this resistance now leaves growers exposed to potential on-farm levels of septoria not seen for many years," says Bill. The open mild autumn and generally very good drilling conditions mean high infection levels could be carried through the winter.

"We are in the hands of winter weather patterns." A mild winter will see crops continue vegetative growth and a wet spring will mean a heavy inoculum pressure.

Blending wheat varieties has some merit, especially with more disease-prone Group 4s, says AWC's Felix Austin.

"Previous work by AHDB highlighted the variety-specific nature of the Cougar septoria population and this appears to be the case now. We should not have been caught unawares as the issue was seen in Ireland and in the west of the UK in trials in 2020, before becoming a national problem in 2021.

"Any increase in Cougar derivatives will encourage more development," Bill believes. "It is good that we are seeing some

Tussock trials deliver real-time resistance ratings

Rosemary Bayles, former head of NIAB'S Pathology Department, helped Agrii and Bill Angus commence tussock trials across the UK ten years ago.

Agrii, together with Bill and Rosemary Bayles, the former head of the NIAB Pathology Department, commenced so-called tussock trials across the UK ten years ago, explain the firm's Colin Lloyd and John Miles.

Typically involving 35 varieties/parental lines grown across 12 locations from Scotland to Cornwall and Wales to East Anglia they don't look particularly exciting, just hand sown dinner plate sized 'tussocks'. But they have given a real-time indication of disease pressures over the complete range of parental lines, with nothing averaged over years, forming the backbone of Agrii's Advisory List for winter wheat.

The first year of monitoring showed that on one site JB Diego, which had good yellow rust resistance, had 'fallen apart'. The following year this was apparent across many sites, so agronomists and growers could be urged to be vigilant.

Shortly after Hereford as a parent line in the tussocks broke down on one site and half the sites the following year. The 'barometer' system had again given valuable insight into the potential for issues over the next year or two, which proved to be the case in KWS Zyatt, Dunston, Gleam, Shabras and SY Insitor, for example, with Agrii able to advise growers ahead of the curve.

Bill and Rosemary continued to adapt the genetics entered into the tussocks and two years ago a problem with yellow rust in KWS Firefly was noted. This variety previously had good resistance, including juvenile resistance, held together by its Cougar parent. The questions raised by the Agrii technical team with Bill were 'why' and 'would it just be a yellow rust breakdown?'

Agrii's Advisory List for winter wheat draws on 35 varieties/parental lines grown across 12 locations from Scotland to Cornwall and Wales to East Anglia, explain the firm's Colin Lloyd and John Miles.

In 2021 doubt turned to fact as septoria became a real problem for Firefly and many other Cougar crosses — a real blow to growers — showing what can happen when dealing with what is a narrow set of genetic diversity being used in the UK.

The good news is that breeders are now 'on the case' of bringing in new genetics as exemplified by KWS Extase and Theodore as examples, says Bill. "The important thing now is to develop a strategy to deploy these resistances and protect them from future breakdowns."

Rules for mixing wheat varieties

1. Only consider mixtures for feed wheats – don't compromise any potential premiums by producing 'mixed grain'
2. Review hard wheat pedigrees – avoid any two varieties which share a common lineage
3. Include a high specific weight variety if possible – feed wheats can be challenging in terms of specific weights and a higher specific weight component will help
4. Optimal number of varieties should be three
5. Ask the potential buyers as to their views on purchase options.

Hybrid wheats will bring improved and more consistent yields, which will mitigate some of the risks growers encounter, says Sarah Middleton seeds market manager for BASF.

differences between Cougar derived varieties, as minor genes carried forward with the Cougar resistance are manifest, but it is too early to say whether these will be more durable."

Bill has similar concerns around yellow rust. "2021 was a low yellow rust year for many. Protracted frosts through April and May slowed development, followed by a very wet summer. Yellow rust really doesn't like wet weather — it prefers sunny, warm weather with morning dews, which were rare in 2021.

"However, we now have a large proportion of the UK area that is very susceptible to yellow rust, and the AHDB ratings understate the threat. When we see such rapid race evolution the current three year means have low relevance — growers want ratings based on real time." (See panel).

An equally judicious approach to other agronomic factors is needed, respecting environmental challenges, but watching out for the unintended consequences of change.

"Growers have always been the custodians of our 'land bank' and you only need to move around the country to see what a great job they have been doing. However, there needs to be a *sustainable* balance between food production and environmental considerations," says Bill.

"There is much that the organic movement and conventional growers can learn from each other. But I have grave concerns over the use of non-treated seed as part of a cost saving regime. We have been successful in keeping bunt (also called stinking smut) at bay using chemical seed treatments. This nasty disease could become prevalent if untreated seed is used," he warns. "Years of work eradicating bunt could be wasted."

Similarly, min-till has a place, but unburied trash can lead to higher levels of disease inoculum in subsequent crops. "We need to see if we can select varieties which will have improved performance under such challenging conditions."

Variety mixtures are another talking point where consequences need considering. "I am a supporter of variety mixtures, but again growers need to think carefully about how to exploit these. Certainly as a contributor to disease control they can have a place — though they will not replace fungicide use."

Milling wheat

Variety mixes are only suitable in the feed wheat sector, he warns. Within the bread and biscuit quality groups (nabim 1, 2 and 3) each variety has its own unique varietal characteristics which millers understand and optimise as they make flour grists.

Felix Austin, wheat breeder at AWC, adds that the feed wheat sector — particularly hard feed wheats — is very vulnerable to many of the disease threats, so could be targeted for variety mixes.

Choosing mix partners is simple if based on variety pedigrees, he says. Though much has been made of the narrow genetic base used by wheat breeders, there are some interesting new sets of genetics coming through. A few minutes sitting with the variety pedigrees will indicate possible options, but be sure to observe a few common 'mixing rules', he adds (see panel above).

Despite all the challenges Bill is optimistic. "I have the highest regard for our growers and they have been subject to a range of challenges over the years, but still delivered high yields of quality grain. Likewise the breeding community is the most dynamic and competitive in the world, with thousands of new combinations evaluated every year. It's good to see that the newer fungicides are holding up when used at the appropriate timings."

Jon Helliwell from BASF confirms that in 2021 across different varietal genetics there was a clear benefit from the latest chemistry. "Trials have shown that using conventional azole + SDHI combinations left crops exposed compared with Revystar XE in 2021," he says.

Hybrid Wheat

One area of particular promise is hybrid wheat. Sarah Middleton, seeds market manager for BASF, is optimistic about the role hybrids can play in the new challenging agronomic scenario. "By bringing together diverse pools of genetic materials from around the world, thus enhancing diversity, this can then be adapted to different regions. We will see improved and more consistent yields, which will help mitigate some of the risks that growers encounter. The BASF hybrid wheat platform is also designed to faster deliver value-added as well as agronomic traits." ■

Innovation Insight

CPM would like to thank F1 Seed for kindly sponsoring this article and Angus Wheat Consultants for providing privileged access to staff and the material used to help put this article together.