Arable farming 2050

Future of crop production

Rather than look back at times gone by, *CPM* marks its 25 years in the business by exploring what the future could hold for crop production – sharing the valued viewpoints of those at the helm now, as well as the next generation of industry experts.

By Janine Adamson

SRUC's Professor Fiona Burnett believes innovative solutions can't be used to prop up otherwise unsustainable production methods.

It'd be easy to reminisce about the times when *CPM* first came to fruition as means of marking each significant birthday for the magazine. But to truly live by its values, the publication has to look forward and present new ways of thinking which inspire, stimulate and inform.

It's now been 25 years since *CPM* first entered the world of agricultural publishing. Should the magazine continue for a further 25 years – or should that be 25 harvests – what might arable farming look like as society approaches 2050?

Plant health

According to SRUC's Professor Fiona Burnett, the direction of travel is shifting disease control from being input intensive with one-size-fits-all spray programmes, to knowledge intensive with clever tailoring to the context and field or sub-field.

"The drive and desire to be less reliant on pesticides and to manage disease in more integrated and regenerative ways are very real. New tools and techniques keep being added and we're learning more and more each season," she says.

For Fiona, the concern is disease burden as new threats, as well as new strains of existing pathogens, continue to mount. "Fungicide-resistant strains of pathogens such as potato blight and septoria will remain a challenge. Our move to more integrated crop practices brings many benefits, but we also have to be aware that with new approaches, we'll see greater diversity. For example, with more grass in arable settings we'll experience more issues like ergot.

"And as the climate changes, this brings additional threats – black stem rust in wheat is just one example of a pathogen we think is possible under warmer conditions."

Fiona believes it's time to move away from the current binary approach to certain technologies. "The likes of gene editing remains contentious with strong opinions on both sides; pesticides are similar. If we could have more of a meeting in the middle, we could really change mindsets across the board.

"We absolutely can't use these innovative solutions to prop up otherwise unsustainable production methods, but carefully integrated into lower input and regenerative systems, they could be key in getting the balance right between yield and environmental gains."

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A broader issue for Fiona is that research science and applied practice are drifting apart. "Academics with fantastic innovations are rewarded for scientific papers but not so much for getting out and about in practice. This means there's a real opportunity for people who are prepared to fill that connected middle ground," she adds.

Agronomy

The Agricultural Industries Confederation (AIC)'s head of crop protection and agronomy, Hazel Doonan, recently celebrated 20 years in her role. She believes the future of agronomy centres around precision farming and attention to detail. "Access to new technologies will enable much more detail and granularity, while pinpointing and improving the efficiency of inputs.

"With that comes data and it'll be down to advisors to help translate that information, guide interpretation and identify trends at a per farm level," she says.

Recognising the growing importance of environmental management and its ranking on the government's agenda, Hazel adds that this will continue to instigate change. "As rotations widen and diversify to include more cover crops and niche options, with that comes a demand for agronomic advice.

"But the current lack of policy is a

As rotations widen and diversify to include more cover crops and niche options, with that comes a demand for agronomic advice, says AIC's Hazel Doonan.

huge threat – farmers have to forward plan and therefore require clear direction from government on land use whether that be for food, fibre, energy production or housing. We're being asked to produce more food than ever before yet all of those aspects are competing for the same land," stresses Hazel.

Managing director of Agrovista, Chris Clayton, agrees: "The greatest threat we face isn't to agronomy, it's to UK food production. For one, Dimbleby's National Food Strategy which was meant to be an independent review for government, has sat gathering dust. We still haven't worked out what we actually want for UK food production.

"If we continually create hurdles for ourselves – for example, greening policies to give society a 'warm feeling' while importing instead – there's a threat to UK farming as we know it."

According to Agrovista's Chris Clayton, it's part of an agronomist's role to take growers on the journey to digitisation.

Even so, Chris believes there'll long be a role for agronomists. "Simply put, agronomy is the provision of advice and support to a grower base to help maximise returns from growing crops. Assuming as a nation we want to continue producing food, the demand will be there.

"However, what this provision looks like will constantly evolve. You only have to take the past 12 months and development of SFI, and how this has become a staple part of an agronomist's role, to illustrate that point," he continues.

"Right now, the speed of change is at its greatest and that's likely to continue. What's evident is it's important an agronomist has a full set of skills if they wish to be successful in this dynamic industry."

According to Chris, it'll be part of an agronomist's role to take growers on the journey to digitisation. "There's huge scope here – increasing productivity and steering towards better farming practices. Make it your place to fully understand the tactical and strategic challenges that growers face to help ensure their farming business can be passed on to the next generation."

Whereas Hazel believes the growth of agronomic specialisms will come to the fore. "Whether that's related to technology, soils, crops or climate, agronomy is a whole-farm approach, not just crop management anymore.

"It's time to embrace new technologies – some of which will be doing things we never thought of in 25 years – and learn how they can work for you. Surround yourself with experts who can help you, whether that's advisors or peers, and be open to change across the whole supply chain," she says.

Changing the game

CPM posed the question – with respect to your specialism, what's the one problem or dilemma which if solved in the next 25 years, could really change the outlook of arable farming?

Professor Fiona Burnett: "Understanding the best way to use data to inform management decisions, lighten the load of assurance scheme inspections and better evidence practices."

Hazel Doonan: "If government set out their land use ambitions for the UK it would help immensely; focusing on priorities and hopefully renumerating farmers for delivery too."

Chris Clayton: "An absolute congruent National Food Strategy with clarity on what we want to achieve including robust guidance in regard to regulation, which is all based on science and not emotion."

Belinda Clarke: "A clear way for farmers to understand and improve soil health."

Dave Hughes: "Climate change is the most significant existential risk to global society, so reducing greenhouse gas emissions in food production and sequestering carbon in soils at scale will be crucial."

Mark Dodds: "Improved knowledge of plant genomes would take genomic selection to the next level."

Nigel Padbury: "The arrival of a safer insecticide to replace neonicotinoids, or, the development of a resistant variety to help overcome cabbage stem flea beetle."

Peter Scott: "De-commoditise fertiliser so more thought goes into its use to influence buying decisions."

Pamela Chambers: "Varieties – tailormade for every situation – but we are well on that journey!"

AgriTech-E's Dr Belinda Clarke isn't convinced AI will completely replace aspects of agriculture, more that it'll supercharge and enhance.

Technology

A concurrent theme across all segments of crop production is the role of technology, and as such, Agri-TechE's Dr Belinda Clarke believes the greatest opportunity lies in artificial intelligence (AI). "We're just beginning to harness this as an industry and increase our understanding of how it can be used, for example, digital twinning.

"I'm not convinced AI will completely replace aspects of agriculture, more that it'll supercharge and enhance. But with this comes the requirement to train data ▶

to be appropriate and relevant – which is both exciting and challenging," she says.

However, Belinda suggests a threat to the uptake of digital options is the current lack of interoperability between tech solutions. "We see increasing farmer cynicism as a result. The onus has to be on developers to make their solutions work better while managing user expectations."

In future years, she predicts an inevitable consolidation across the agricultural sector. "There'll be fewer players whether that be farmers, manufacturers or technology providers. This could mean we lose diversity of business and entrepreneurial thinking," she warns.

"But we should all keep our minds open to change and allow technology to dictate a little. Be curious and have attention to detail in every aspect of life, especially agriculture. Developing your absorptive capacity to take on new views and ways of doing things will be a valuable skill."

Syngenta's head of technology identification and evaluation for crop protection, Dave Hughes, suggests with agriculture undergoing a blistering pace of chance, it's hard to predict where things may lead. "It's clear we'll be doing things very differently in 25 years' time – almost certainly applying exactly what's required, only when and where it's required, to achieve better results with fewer inputs.

"Furthermore, I see inputs becoming more biological-based, particularly for pest control. History tells us inventing and commercialising novel, highly effective biological products is really hard. However, dramatic improvements in the technologies we use coupled with an increase in demand

The worry for Syngenta's Dave Hughes is, if the anti-tech voice becomes loud enough, politicians could react accordingly.

Rising stars of the trade

As with the first issue of *CPM* released in 1999, the experts who contribute to the magazine come 2050 will likely be a new breadth of names all over again. Despite a reported 'lack of talent', a new generation of skilled specialists are waiting in the wings, preparing to become the future custodians of crop production.

As these individuals continue to graft, ready to receive the baton from those who've rightly earned their kudos, what are their hopes for the future and what's fuelling their fire?

Will Smith, Gowan's technical lead, specialises in weed management and hopes to see that growers and agronomists continue to receive evidenced and accurate advice around the topic. "I'd like to be in a position where I'm central to the development of and communication of weed management research, so driving the industry forward."

According to Will, at its heart, weed science is all about plants – understanding how they function, adapt to the conditions they inhabit, and the subsequent design of strategies to control them in an efficient manner.

"This reaches all the way from fundamental biology such as germination patterns and understanding metabolic systems of plants, to engineering of seed mills, inter-row hoes or electronic engineering. This breadth of opportunity is exciting and always gives you the chance to learn something new."

Hutchinsons' head of integrated crop management, David Howard, believes right now is a really interesting time which should drive innovation. "Central to this is asking how we can add value to a crop without chasing more output. Many are reaching a yield plateau – it can't feasibly keep increasing.

"So we're seeing a change in perception – using precision farming techniques and data to improve efficiencies. The ability to lift on-farm averages overall may address how to improve margins.

"Equally, opportunity lies in rationalising what integrated pest/crop management looks like for farmers. It's often viewed as very intricate, but with the application of technology, it should be possible to achieve."

Admittedly not a fan of milestones, David Howard says his aim is simple – to make a positive impact on the industry during his professional career. "But I like to constantly challenge my views and insights – there's so much resource to tap into, especially since knowledge transfer has improved from academia."

Amy Watkins, Agrii's sustainability manager, agrees with the shift towards margin rather than yield. "With that has to come alternative sources of income beyond food production to ensure the best gross margin/ha. However, with a new government there's an even greater pressure on land use – there's a lot of change but it should be viewed as an opportunity instead of a threat," she says.

In terms of her career aspirations, rather than a job title, Amy strives to live by two mantras. One – work smarter, not harder, and two – success isn't when everyone depends on you, but when you're no longer needed.

"For me, I think it's important to aim for a more balanced lifestyle where work, hobbies and family all have a place. I also hope to empower a team to deliver a cohesive vision, which is all about how you judge success – it's when everyone has adopted your lead and you can leave them to it," she says.

While in plant breeding, RAGT's David Schafer predicts more intention – where breeding will move in a more deliberate direction – and new technology will allow the environment to be decoupled from genetic influence using techniques such as genomic selection. "A further move away from single trait characterisation would also likely be part of this, looking to enhance many traits and stacking effects simultaneously.

"Ultimately, artificial intelligence (AI) and machine learning can recognise patterns which humans can't – we have to direct breeding programmes to best utilise this vital insight," he comments.

From a professional perspective, David Schafer identifies his ultimate trophy to be the delivery of a very high quality, bread making variety. "As a plant breeder, my interest will always be skewed towards delivering varieties. But I'm also keen to contribute to how breeding programmes are set up so greater success can be achieved more readily and genetic gain driven more quickly and reliably."

But even now, David Schafer considers himself to be a dinosaur, as far as science is concerned. "We definitely have to encourage younger people into this industry with new ideas and perspectives," he laughs.

FMC's marketing & plant health lead UK & IE, Geoffrey Bastard, believes with the current rate of crop protection revocations being faster than new product launches, the

for biology-based solutions, is likely to change the landscape considerably."

Along with others, he cites climate change as a significant threat to global agriculture, plus society's attitude to the use of technology in food production. "Many are deeply sceptical about new technologies and believe we should return to growing food as we did 100 years ago, but it's surely obvious that such systems couldn't feed the future global population without destroying huge areas of the planet's remaining wildlands. The worry is, if the anti-tech voice becomes loud enough, politicians could react accordingly."

Instead, Dave believes technology should be used to improve both productivity and sustainability at the same time. "For example, how to truly sequester carbon and reduce greenhouse gas emissions while actually improving crop yields. A lot of smart people are thinking about how this might be done, so providing the ideas come through, this will prove a major growth area.

"But if we're serious about eliminating fossil fuel use, we have to think about carbon-based raw materials for things like medicines, plastics, fibres and liquid fuels which we all depend on. The only feasible way of producing these raw materials at the scale required will be to extract from plants, so in the future, food will be only one output of many which are derived from crops," he says.

Consumer demand for crops with positive environmental credentials is a big driver for change, believes Premium Crops' Nigel Padbury.

Varieties

With coming up to 30 years' experience in plant breeding, KWS' Mark Dodds foresees the role of policy as a means of making or breaking the sector. "The future lies in more targeted solutions. "In a way this is positive because with greater scrutiny comes better environmental profiles which should be more accepted by consumers.

"Equally, there's the potential for technology to compensate – anything which improves environmental or operator safety is a good thing. This includes modelling for pests and diseases, or high-tech detection methods, to ensure products are applied at optimum timings," he says.

With farming being influential in Geoffrey's life from a young age, he says his career goal is to launch a new technology to the market. "Providing farmers with a means of making their lives easier is a very rewarding thing to do," he adds.

For ProCam agronomist Harry James, it's all about taking pride in doing a good job. "Having a positive impact on businesses on a daily basis is what keeps me in the game. I take a pride in my work and the opportunity it gives me to interact with such a diverse range of stakeholders; farming is my obsession," he says.

Harry sees the direction of agronomy mirroring UK agriculture. "Here I'm talking about scale – we can't avoid it – businesses will grow and agronomy will have to reflect that. This could mean losing attention to detail, but by using all of the tools available to us, we should be able to avoid that."

In the future, he sees his role as an interpreter of technology and automation. "With this, I'll be able to service a greater area more efficiently," he comments.

Fresh Produce Solutions' trial manager, Dr Bill Watts, says with the closure of AHDB Potatoes in 2021, it's become challenging for the potato industry to track and estimate national market and production trends. "It seems likely, however, that we'll see a continued trend for declining numbers of growers during the next 25 years with larger and more specialist operations remaining."

Bill perceives the most pressing worry to be late blight, although he says major agrochemical manufacturers are 'industrious' and already bringing alternative actives to the market including biostimulants.

As for his field of work, he says crop production research is fascinating. "To be an applied crop researcher you have to have a mix of skills. Add in international travel opportunities and a role in teaching young people to be researchers, and it's a particularly potent cocktail," concludes Bill.

Clockwise from top left: Geoffrey Bastard, Dr Bill Watts, Amy Watkins, David Schafer, Will Smith, David Howard. Centre: Harry James.

Origin Fertilisers' Peter Scott hopes future disruptive thinking will change the nutrition market for the good.

oilseed rape area has halved following the ban of neonicotinoid seed treatments whereas with SFI, this will add pressure to smaller crops such as winter barley.

"With a reduction in area comes less income, investment and innovation in these crops making policy their biggest threat," he suggests.

Mark believes technologies such as genome editing and AI will make the plant breeding of the future more efficient, whereas the use of drones will be complementary. "Using drones in disease scoring would certainly speed up and automate the evaluation of new varieties if the technology can get to a standard where it can score as well as people.

"It's about deciding which technologies are useful and which aren't, remembering there's no substitution for field work and seeing crops in a practical scenario."

British Sugar's Pam Chambers believes in the future, mavericks should be allowed to flourish.

Premium Crops' Nigel Padbury believes consumer demand for crops with positive environmental credentials is a big driver for change. "UK farmers are already extending rotations with a greater diversity of break crops.

"The move away from the wheat-rape rotations of the 90s and 00s, not only makes agronomic sense, but such variation in cropping brings a greater diversity to the general farm environment."

However, he agrees with Mark: "For all its potential benefits, SFI and similar political measures can represent a threat to a diverse crop environment. Schemes that pay support for not cropping an area can skew the market away from minor crops as farmers retain their acreage of the all-too-familiar wheat and barley and use SFI as a so-called 'break'.

"But, the successful growers of the future will be aware of their value in the supply chain and focus on providing products and services that end users actually want. The alternative is to stick with supplying basic commodities at the lowest possible price," he says.

Nutrition

For Peter Scott, technical director of Origin Fertilisers, the future lies in finding a balance beyond nitrogen reliance. "Yes nitrogen is a primary driver in food production, but it's a leaky system in terms of the environment – it's at the pivot of the sustainability seesaw.

"And although NUE is a useful KPI, we have to know what it is before we strive to improve it, by measuring and benchmarking to understand seasonal and crop variation. That'll take at least 2-3 years at scale and only then can we consider mitigation actions," he says.

He believes a current over-simplification by some retailers and food processors is a concern. "Nutrition is a complex series of processes beyond just aiming to reduce nitrogen use in production. A more sophisticated solution would be to reduce nitrogen 'leakage' instead and reward it."

Peter also sees gains to be had from a better approach to secondary and micro nutrients. "To unlock the correct balance to crop nutrition, we have to think beyond nitrogen and be more prescriptive. We could achieve this through broad-spectrum soil testing as well as plant tissue testing and then analysing the nutrient content of the harvested crop.

"This tells us what should happen, what is happening and then what did actually happen. By identifying and addressing the limiting factors, the result will be better quality crops which are more nutrient-dense," he explains.

Ultimately, Peter hopes future disruptive thinking will change the nutrition market for the good. "At the heart of this is communication, to effectively filter new innovative approaches down to farm level."

Roots

British Sugar's Pamela Chambers anticipates there'll be fewer sugar beet growers in the future with varieties being the key to the crop's success. "It'll be interesting to see how varieties are allowed to develop, for example, the use of gene editing would allow traits to be introduced that'd be of benefit for pest, disease and weed control, as well as other criteria such as drought tolerance."

She highlights emerging threats such as beet moth and cercospora, but that the industry is likely to see more new pests and diseases which won't be known until they arrive. However, it's weeds which are of greatest concern.

"In my lifetime we've seen resistance issues increase and different weeds become a problem. We must learn from the mistakes made in the past and work together across the entire arable rotation, not just in sugar beet," she stresses.

Equally, Pam believes for all crops, customer demands will increase and as a result, the industry has to listen. "We'll be competing with European and global producers so have to be aware of the direction they're travelling – likely to be less reliant on plant production products while reducing the carbon footprint of production."

She hopes that in the future, mavericks will be allowed to flourish. "Give people the opportunity to do strange and weird things and to have an opinion. Equally, we shouldn't cut down the 'tall poppies' or over-criticise those who are being successful, rather observe what they're doing and learn.

"During my career it's been my network of friends and contacts who've helped me. It doesn't matter who you work for, we should all be able to offer help and respect each other," she concludes. ■

Grower POVs

For grower perspectives on the future of crop production, read this issue's opinion columns from Guy Smith, Martin Lines and Andrew Wilson.