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The future requires ingenious thinking

Technical Innovation

Converging technologies are fuelling innovations that could aid increased food production in a sustainable way. *CPM* finds out what fuels innovation and some of the things that get in the way.

By *Lucy de la Pasture*

We live in a world where technology is advancing at an unprecedented pace. Just 30 years ago, mobile phones were the size of bricks and barely mobile. Now we have smart phones that are wafer thin and light as a feather. Yet within their sleek exterior, there's such a powerhouse of functionality that most of the human race find it hard to be without one.

Smart phones are an example of successful innovation, explains Prof Sa'ad Medhat, chief executive of the Institute for

Innovation and Knowledge Exchange in London. They tick the box when it comes to meeting the defining principles of innovation — generating economic value and providing a benefit to society — so much so, that any negatives are mostly overlooked.

“We all know that mobile phones increase our exposure to radiation and the long-term effect of this is unknown, but we continue to use them all the same,” he comments.

Public perception

On the other hand, the advent of green biotechnology and genetically modified (GM) crops was one of the most divisive innovations in agriculture. Met with public outcry and fears of ‘frankenstein food’, public perception effectively put the kybosh on adoption of the technology by growers and demonstrates that some innovations are more acceptable than others, he says.

Agriculture has one of the biggest challenges facing any industry. There's not just the predicted expansion of the global population to 9.1 billion by the year 2050. According to EU Commissioner for agriculture and rural development, Phil Hogan, in his recent speech at the World Food Day Conference, an extra 3bn people are predicted to become more affluent and join the middle classes in the next 20 years, which will put further pressure on food supply.



Sa'ad Medhat reckons the imperative nature of the food production problem will drive solutions through innovation.

Although part of the solution will be found in chemistry, Sa'ad Medhat reckons the imperative nature of the food production problem will drive solutions through innovation, but over a much wider platform than crop protection alone.

“There's a need to increase food production to meet the basic needs of people. But there are also numerous problems associated with doing this. In addition to the challenges of ▶



Five years after the implementation of 1107/2009, the first two active ingredients have just been approved through the new process, notes Paul Leonard.

► climate change and increasing severe weather events, land and water are both limited resources. Urbanisation continues to reduce land available for food production and increasing environmental degradation means that the bottom line is we'll need to produce more food from less land," he says.

It all adds up to an increase in world food production of 70% over 2005 levels and at a time when Europe is feeling the impact of Plant Protection Products (PPP) Regulation (EC) number 1107/2009. Under this regulation, pesticides are increasingly evaluated according to their intrinsic 'hazard' rather than actual 'risk'. This results in a loss of active ingredients and a slowing of the innovation pipeline, explains Paul Leonard, of BASF EU government relations, innovation and technology policy.

"A startling fact is that, five years after the implementation of 1107/2009, we have only just had the first approvals of two new active substances. Up until now, those approved were under the old 'risk-based' legislation. That's not a friendly timeline for innovation."

While there's been a slow-down in growth in the EU-15 in the past ten years, growth and technological innovation are accelerating in other parts of the world, particularly Asia and the Americas, he explains.

"It's partly due to the loss of active ingredients but also the conflicting demands of regulatory compliance and innovation which are being placed on R&D budgets. The more money which has to be spent addressing escalating regulatory requirements, the less money is available for real innovations," says Paul Leonard.

With the majority of actives only just entering the renewal phase, where they'll be assessed under the new regulatory cut-off

criteria for the first time, the new regulations are only just beginning to show their teeth. The criteria for endocrine disruptors (ED) is currently being defined by the EU but the impact this will have on chemistry is still unclear, particularly for crop protection products, such as azole fungicides.

"These products could be considered to exhibit ED properties, based on their biochemical mode of action (aromatase inhibition), but that doesn't mean they are EDs. The EU criteria for ED have not yet been adopted and continue to be both scientifically and politically contentious," he comments.

ED criteria

"It's not known what impact ED criteria adopted by legislators will have on crop protection. We'll find out the extent to which azole fungicides may or may not trigger the ED criteria when they are finally defined, adopted and implemented in the regulatory decision-making process. In the meantime, it's a source of continuing concern, especially for farmers and countries which export agricultural products into the EU," he adds.

Azoles form a vital component of fungicide anti-resistance programmes, especially as partner products for SDHI fungicides. Hopes are pinned on a possible derogation to prolong the prospects of azole chemistry, where any potential risks can be proven negligible, but even this is currently looking doubtful, explains Paul Leonard.

And there's a problem with this approach, he points out. "Any legislation based on derogations is poor legislation and very bad for innovation and investment. A tricky regulatory environment leads to defensive R&D, with companies spending more money on compliance with legislation than on innovation, because compliance eats into limited R&D budgets.

"For example, EU legislation on particulate emissions in diesel tractor engines tied up 80% of tractor manufacturer's R&D budgets for five years to get engines to comply. The end result is less fuel efficient and more expensive to manufacture."

One of the biggest success stories in agricultural innovation in recent years is precision farming. In the past ten years, precision agriculture has moved from a position of good science to good practice with more than 70% of new equipment having some form of precision agriculture component inside.

But there are many other technologies being harnessed in food production and some of these are borrowed from other industries. Nanotechnology has applications

in a range of areas from nutritional delivery to seed coatings. Robotics is used in crop production right the way through the supply chain and LED lighting systems are being used to accelerate food production in some systems. But what we're now beginning to see is a convergence in technologies underpinning the whole platform of innovation, explains Sa'ad Medhat.

Open-innovation, where skills are brought in from 'outside' and data shared, has been very successful in IT and expanding this concept in agriculture would help enable different technologies to come together, he suggests.

There's a huge opportunity for innovations in food storage and processing to increase shelf life and reduce waste. Currently it's estimated that for every 100 calories of food produced, only 35 calories are utilised, he points out.

"Integration of innovative technologies will undoubtedly help farmers achieve increased yields but ultimately they'll also help the city ecosystem to become 'smarter'. Systems like vertical farming, urban greening and the development of smart cities, created with internet-of-things technologies, are possibly the future of urban living," he believes.

The importance of innovation to agriculture isn't being overlooked by the UK organisation whose vision is to empower growers to be more competitive and sustainable. The subject has been under much recent discussion within the Agricultural and Horticultural Development Board (AHDB), according to its knowledge exchange director, Susannah Bolton.

"One of our critical objectives is to provide growers with greater access to innovation in all its shapes and forms. Innovations can be new products or machinery but may also be novel ways of using an established technology or using a technology borrowed from another industry," she explains.

"We recognise that growers are becoming



Urban greening and the development of smart cities, created with Internet of things technologies, are possibly the future of urban living.

Loss of active ingredients



Assessing pesticides according to their 'hazard' rather than 'risk' in the EU has resulted in a slowing of the innovation pipeline.

*Results of study undertaken for ECPA and CropLife America by Philips McDougall, 2013

more innovative themselves, with many doing their own trials to look at what works best in their situation. Part of our vision is to make innovation easier for growers by putting steps in that help make the decisions



There are now examples in crop production of the convergence in technologies that are underpinning the whole platform of innovation.

that facilitate change easier while removing some of the risk from the grower of adopting a new technology," she adds.

So how does she envisage overcoming some of the barriers to the uptake of technology and to innovators themselves?

Participatory approach

"From a research perspective, we're looking at a more participatory approach with growers when it comes to trialling and testing new technologies so the risk to growers is reduced. We can deliver this by developing farm excellence structures, such as the Monitor farms, but also by forming closer partnerships with the Agri-tech and established research centres," she explains.

"But a key element to making innovation more accessible is to relate it to a commercial farm practice. The impact on farm economics of adopting a new technology needs to be clear so we need to increase bench-marking activity to provide both the costs and benefits associated with any changes to farming practice."

On a wider scale, there's a move afoot in Brussels that may be good news for growers. The aim is to make Europe a less risky and expensive environment for innovators, explains Paul Leonard.

"The issue of increasing costs of compliance led to the proposal of the Innovation principle (IP) by the European Risk Forum, which states 'Whenever legislation is under consideration, the impact on innovation should be taken into account and addressed in the policy and legislative process'. Its adoption would help ensure the need to protect Europe's ability to innovate is not forgotten when writing or interpreting legislation," he says.

"The EU can't be globally competitive if



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it's trying to eradicate technological risk and momentum is growing to ask the policy makers for a change in mindset. 22 CEOs of companies, across a range of industries, have signed up to the IP. With a combined R&D spend of €30bn and 1.5M employees, the people in Brussels are taking the IP seriously."

As far as growers are concerned, they're already making adjustments on the basis that chemistry will be lost and are turning to innovations in plant breeding as a way of dealing with the reduction in fungicide efficacy, says Scottish Agronomy's Andrew Gilchrist.

"The chemical 'prop' that existed a decade ago is diminishing so growers are being more innovative on farm and adopting a more holistic approach to growing crops," he says. ■

Brexit may help innovation flourish

The decision to Brexit means it's an interesting time for the UK, believes Paul Leonard.

"As much as fingers were crossed in Europe that the UK would vote to stay in, the decision to Brexit presents some important decisions to be made but also opportunities for the farming community. Legislation in the EU is presenting strong challenges and ultimately the UK won't be restrained to the same extent by EU policymakers and the debate in Brussels.

"Post Brexit, the UK will be able to choose the technologies that they're comfortable with. The country can become a first class 'laboratory', right on the doorstep of Europe. It's already a country with good soil, climate

and scientific institutions and will have the opportunity to be the innovators of Europe — potentially an interesting scenario for investors as a proving ground for new technologies," he adds.

"The UK has always been a pragmatic partner in member state discussions relating to plant protection product regulation. For example, the UK didn't support the move to hazard-based systems for approval of PPP from one based on scientific risk evaluation. They didn't support the EU stance on neonics or glyphosate and were very supportive of green biotechnology, hosting GM trials.

"The UK will be able to make more decisions



Britain could potentially become more interesting for investors post Brexit as a country less constrained by the EU regulations.

as a pioneering Agri-tech country, free from many of the burdens which result from EU legislation," he believes.