

Bruce Knight recently prepared the following article ([Crop Protection Monthly - November 2010](#)) from a conference looking at how technology can help meet the challenge of feeding 9 billion people.

SCANNING THE AGRICULTURAL HORIZON TO 2050

A one day conference titled Scanning the agricultural horizon to 2050 was organised by the UK's SCI BioResources Group with the support of the Royal Society of Chemistry and hosted by Syngenta at its Jealott's Hill Research centre, on 30 November. The premise for the seminar was that global food production has to double by 2050. Bruce Knight reports on some of the presentations.

The challenge

The first two papers at this forward looking conference outlined the challenge. The first paper describing the "Agricultural Treadmill" was given by Professor Harald von Witzke, Humboldt University, Berlin. This elaborated on information presented earlier in the year (March CPM). He reiterated the arguments that to meet greater demands for food and under increased energy costs, as well as safeguarding climate change impact and biodiversity, the only viable route was through increased productivity and therefore investment in R&D. He considers that policy makers need to recognise that the social rate of return from agricultural research, measured in terms of increased productivity for society at large, is high at around 30-50%.

The EU is the single largest net importer of food. Exports from the region in 2008 were valued at \$128 billion, but imports were \$173 billion, a net deficit of £45 billion. China was a close second and is responding by land grabbing in Africa and elsewhere. The EU is not a land grabber, but can be described as a "virtual land grabber" as it needs extended areas of land outside of the EU to satisfy its needs. Based on 2007-8 data the actual area needed was 35 million hectares. With productivity increases this could be reduced to 30 million hectares, but if the supply was from organic production the area needed would be 45 million hectares.

Rainer von Mielecki, BASF, Limburgerhof, covered the pending conflicts over land use, water availability and energy, for food production. Future water availability is critical. Around 70% of water use is for agriculture, so he said: "...water grabbing goes with land grabbing". While daily consumption of drinking water is only about 2-4 litres per person, it takes 2-5,000 litres to produce the daily intake of food. Furthermore by 2025 it is estimated that two thirds of the global population will be living in drought affected regions. Delivering water to the right place is possible and desalination and purification methods do exist but need refinement. Producing more from less land calls for a pulling together of the economic, ecological and social drivers. In his view what industry has to do is encourage better and more efficient integration of technologies through dialogue.

Can chemistry deliver ?

David Lawrence, former Syngenta Group R & D director, presented a more optimistic picture on the potential of science and particularly chemistry to deliver. He said the challenge could be met by a mix of several factors: by increasing yields in all regions; by eliminating food waste; and by moving away from meat diets and raising food production derived from the sea to at least 25% of that from land.

There needs to be a regeneration of research in soil science and improved efficiency in nitrogen fixation is a clear requirement. Biological routes will include extending nitrogen fixation ability to crops other than legumes and improved efficiency through gene transfer. Chemically there is much to be achieved in the nitrogen fertiliser production process. Using renewable energy sources has scope as does nano catalysis in the production cycle. Increased water availability for crop production through improved desalination methods, sensor managed irrigation systems and the use of soil applied chemicals to reduce drought stress are also chemical routes.

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Crop enhancement chemicals such as Syngenta's Moddus growth regulator can reduce water demand by 15% and yet still deliver yield benefits of 15-25%. In conventional chemical crop protection, new molecule discovery remains vital particularly to improve management for agrochemical resistance. Seed treatment chemicals could offer up to 50% yield benefits where plants are subjected to abiotic stress.

New approaches to crop protection

Jonathan Margolis, AgraQuest, California, described how the complexities of soil organisms had been more fully understood over the last five to seven years. Most organisms are associated with a complex population of microbes and plants are no exception. Up to 10⁹ bacteria per gramme exist in the soil. In his opinion we are only now scratching the surface of developing microbiologicals which can offer real benefits. By improved genomic tracking techniques and diagnostics it is possible to characterise and enhance microbes to benefit the growing crops. Work has shown that chemical signals from the plantcolonising bacteria trigger physiological changes in their host plants, leading to increased growth and yields.

AgraQuest has commercialised two products and have around 15 more in development. Serenade (*Bacillus subtilis*), a microbial seed treatment, increased the yield of beans in trials by 13.8% compared with untreated controls. Conventional chemical treatments gave a 6.0% yield increase.

Mike Bushell, Syngenta, outlined a range of approaches adopted by Syngenta at discovery level and in development. Formulation is recognised as a key part of the development process and at Jealott's Hill a robotic formulation development and sample production facility have recently been commissioned. The laboratory was opened in 2009 and has the potential to create and test up to 1000 formulations per day. He also explained how Syngenta was giving priority to assisting smallholders in developing countries to benefit from new technologies. While appropriate packaging and the training of extension workers are important factors real success requires partnerships to be established at a local level to bring in finance and investment in logistics.