SECTION ONE

THE IMPACT OF INNOVATORY PLANT SCIENCE ON FOOD SECURITY

This section outlines the background to the challenges of food security and describes a diverse range of appropriate technologies based on current knowledge and progress in plant science. These technologies aid sustainable production, improve the nutritional quality of crops and help to reduce levels of food waste both pre- and post-harvest. There is no one-size-fits-all, no single silver-bullet solution, but a range of biotechnologies with advantages in specific contexts.

The world may well be on the way to securing its food supply in the face of a peaking global population that begins to feel the first major effects of man-made climate change.

Innovation to promote food security can take place at different levels. Crop technologies may be traditional, intermediate or conventional, or so-called new platform. A traditional approach might be, for example, a community-developed method of irrigation. A conventional category of innovation is the development of hybrid African/Asian species of rice through tissue culture, which is frequently used for reproducing plants of the same variety, or the new generation of agrochemicals that directly enhance the defences of plants to pathogens rather than targeting the pathogens themselves. Intermediate is somewhere between the two – part local knowledge, part modern methods – for example the use of companion cropping, such as planting an insect-repellent species in the vicinity of a valuable food crop to protect it from pests.

The recent category of new-platform technologies includes "new genetics", drawing on our growing knowledge of DNA sequence data – the precise ordering of the four bases adenine, guanine, cytosine and thymine in a strand of DNA. And it is now possible not just to describe the sequence of genes within a plant but to go one stage further and link sequences in a plant's genome to its particular characteristics, referred to as "traits". This means that breeders can produce more precisely tailored crops – both major ones and minor locally grown ones – based on knowledge of the appropriate genetic sequences. They can also look forward to transferring desired traits such as yield, pest resistance and drought resistance between varieties using genetic modification (GM) technology – enhancing one crop through the genes of another or its wild relatives. A further exciting development in genomic sequencing is that it offers the prospect of predicting the performance of new varieties.

In all this discussion of plant technologies, the farmer is not overlooked. Modern biotechnology is often regarded as the exclusive province of multinational corporations whose interests go against those of small farmers and less developed countries. This is not always so, however, as these chapters illustrate. Big agricultural business may need to focus on big targets that can be reached in many regions and over very large areas of land, using industrialised agricultural systems to produce such major crops as rice or maize. But biotechnology in general, and GM in particular, may prove to be most beneficial when used alongside traditional or intermediate technology and with local – often staple – but hitherto largely neglected orphan crops such as banana, pigeon pea, cowpea, sorghum, cassava and plantain, amongst many others. A hundred of these crops have been listed by the African Orphan Crops Consortium, which aims to sequence their genomes.

Orphan crops: "A group of crops that are vital to the economy of developing countries due to their suitability to the agro-ecology and socio-economic conditions, but [which] remain largely unimproved."
Africa Technology Development Forum, 2009

If a framework can be found to establish this integration, the world may well be on the way to securing its food supply in the face of a peaking global population that begins to feel the first major effects of man-made climate change.