Presentation by Chris Whitty at the CABI global summit: food security in a climate of change, 19-21 October, 2009

May I begin by thanking CABI for organising this wide ranging and very interesting conference on food security in a climate of change. The Department for International Development supports CABI in a number of ways because of the excellence of the work you all do and I will come back to some of this work later. I would also like to thank the Honourable Minister, Mr Gui, for his speech. What China has achieved is remarkable. Of the many changes and challenges for food security at this point in time the success of China is one of the most encouraging ones.

As a prelude to what you will be discussing in the conference I am going to talk about complexity, and the need to consider multiple problems, and embrace multiple solutions at the same time, rather than taking a one-dimensional approach to the issues of food security. My argument is that this not only is necessary, but that it is actually desirable. Having a more complex response will also allow it to be a more flexible response.

Anyone reading newspaper headlines as their only source of information might believe that in agriculture and food security things are getting worse all the time. The list of problems is long, and real. It includes a population which is growing at a rate faster than agricultural production in many areas, increased volatility of food prices which affects the poorest, the current economic downturn, and of course the looming problems which will occur on account of climate change even with the most optimistic predictions from responsible scientists.

The picture is however more complex than this as those of you in this room are well aware. The conference will be discussing four broad themes - food security in the context of the MDGs, climate change, trade and markets, and information and communication in agricultural development. Each of these has different, although overlapping, complexities, which is of course why the conference is worth having at all. I will concentrate on the first two but would like to pay tribute to what CABI has done in the other areas including in particular the provision of information to farmers and policy makers in agriculture around the world.

As is obvious to everybody here the food crisis of 2008 was caused by multiple factors and was for many people in poorer parts of the world a disaster. Some of the estimates, which can only be educated guesses, are that an additional 110 million people were brought into hunger, and permanent damage occurred with more than 14 million malnourished children. It is not difficult to imagine the impact of a 50% increase in food prices on a family of five in Bangladesh that already spends $3 of its daily income of $5 on food. Only 50 cents would be left for all other household expenses including health, energy, clothing, schooling etc. Immediate coping strategies will have long term consequences, include cutting back to one meal a day of lower nutritional quality, and pulling children out of school. Whilst the price of most staples has now settled slightly, they still remain high for most poor people. The only upside to this situation is that it has jolted governments, including many of the richer governments, into recognising that food security is a major issue. This is not a problem that is going to go away; global food demand is set to increase by 15% by 2030 and double by 2050 if current population trends continue. Governments and policy-makers outside the agricultural sector recognising that there is a problem is a start.

This is however a complex problem and deserves complex linked responses based on clear evidence of what works to minimise the danger that choices made in isolation of one another pull in different directions. The first Millennium Development Goal aims to eradicate extreme poverty and hunger. Both are essential. There are however potentially different policy responses if your primary goal in aiming to increase agricultural productivity is to lift people out of poverty, than if it is primarily to provide food security especially for the poorest.

An example of this would be the differing policy responses to an objective of increased household staple crop production and those to increase export-led growth into high value markets. Both are valid but the policy and public investment responses required may be significantly different. Agriculture plays multiple roles within national economies. Policies to develop agriculture as a driver of economic growth, as a means of delivering social protection

to the rural poor, as a means of ensuring declining staple food prices for the urban poor all need to be taken into account, although to different degrees in different settings.

In addition to these real choices in policy there are also a number of potentially essentially false choices, largely driven by advocacy groups, which can take a lot of debating time without necessarily improving policy. Some people for example try to force a choice between improved technology in agriculture on the one hand, and maximising output from existing technology on the other, when it should be obvious both are needed. In all areas, not just agriculture, there is a substantial gap between what is achievable with the existing technology and what actually occurs in practice. In my own first trade of medicine the Piot mathematical model of the gap between efficacy (the best achievable outcome) and effectiveness (the actual achieved outcome) for any intervention was developed for tuberculosis control but is as applicable in most fields of development including agriculture. Take a 95% effective drug for controlling internal parasites, a major problem for livestock keepers globally, maybe only 50% seek care, of whom maybe 70% will receive the correct diagnosis, of which 90% are prescribed the right drugs and 80% of those can afford to buy them if they are available locally. The drugs may be of low quality in 10% of cases, and will not be administered correctly in maybe another 30%. Very soon your 95% effective drug has an impact of only 3%.

This step-by-step difference between theoretical efficacy and operational effectiveness is one factor that explains the “yield-gap” that exists between the agricultural productivity per hectare on agricultural experimental stations, or on-farm demonstration plots controlled by technicians, and the yields of ordinary farmers doing it for a living. Typical yield gaps vary from 50 to over 300%. Another factor is the extremely long time-lag of getting new agricultural ideas into widespread practice. Recent studies have shown this “generation interval” of new agricultural technology to be between 25 and 30 years for the majority of innovations. Current studies for example suggest only 3% of farmers in Africa use improved crop varieties that would have a substantial positive impact on their yields.

Since there is no single cause for the yield gap, but rather a series of individual and often independent steps which degrade the yield from theoretical maximum to operational output there is no single intervention which is going to improve this. Rather, multiple interventions tailored to every stage which leads to the degradation of the impact from theoretical maximum yield if all farmers used optimal technology to operational practice are needed, concentrating on those steps which lead to the greatest falloff of effectiveness. This complex and multi-stage response is always going to be less immediately attractive to policymakers than a single silver-bullet response, but it is the reality, and trying to simplify away a complex reality seldom helps effective policymaking.

One of the things which is excellent about CABI's work is that it does recognise this complexity and operates at multiple stages along the long pathway from efficacy to effectiveness. One example, to tackle the lack of knowledge of farmers of new plant infections are plant clinics that evolved since 2000 in Bolivia with CABI and DFID support. The plant clinics receive any problem, on any crop, and give written and verbal recommendations, immediately if possible. Most clinics are held at weekly farmers markets, where people from many surrounding communities can seek help. The clinic staff write fact sheets for farmers on common problems.

From 2000 to early 2009 ten clinics received more than 9000 queries on over 100 crops. The diversity of crops and problems are a big challenge to the clinic staff yet with basic training and practical experience they learn to diagnose most problems. However, they do need access to expert support to solve some of the more difficult problems and improve the quality of advice.

Impacts so far include poverty alleviation, increased food availability, reduction in pesticide abuse, increased harvests and improved fertilizer use. The plant health clinics in Bolivia enabled extension and research to reach more farmers with a timely low-cost service that was not otherwise available to them.

The CABI plant clinic approach has now spread to other countries in Latin America, Asia and Africa and constitutes not only a source of much needed problem solving advice for farmers but also a potentially powerful surveillance and early warning system for pest and disease outbreak control at national, regional and international levels. Preventing loss of existing crops to disease or poor storage is as important as growing more.

Recognising that delivery of existing technology to poorer farmers is necessary does not however mean it is sufficient. Because of the yield gap and the need for multiple interventions it is easy to see how some people think 'clearly all our interventions should be to improve existing technologies before we start producing new ones.' This is however to miss several points. The first is that if we stand still scientifically we will actually move backwards in practice; new diseases and pests, and changes in the environment of which climate change is only one will gradually erode even what we have. Secondly almost every one of the remarkable steps forward historically from Britain's own green revolution onwards have been based on multiple technological advances.

Thirdly only when a technology is so much better than an existing technology that it produces obvious benefits will it be attractive to farmers and others to take up. Getting to this point often requires multiple small steps, no one of which provides a sufficient incentive for farmers to change practice and take it up. This patient, complex, steady build-up of advantages is much more realistic than a single brilliant technological leap forward which tends to be the popular view of scientific advance. There bears some similarity to what biologists think happened during evolution, punctuated equilibrium, which explains why there are often major gaps in the fossil record, 'missing links'. Species do not seem to change in gradually but rather when in some areas a new species developing gradually in isolation gets to be so much better adapted that others its simply displaces all competing specifies across the board. The same is often true of ideas, and particularly of technologies.

Conventional approaches to agricultural development have assumed innovation to be a consequence of research that flows from researchers, through extension staff to farmers. The packaged research findings are expected to be readily adoptable by all farmers and low uptake rates are often attributed to "resistance to change".

More recent approaches to understanding the impact of research in development, including some pioneering work by CABI, place greater emphasis on the dynamic socio-economic, political and environmental contexts and on the importance of many different actors and organisations in driving the "innovation system".

Since it is only when a combination of advances makes a new technology so much better than the existing technology that it will overcome the inertia and costs associated with major change, it is unrealistic to think that every small advance in technology will be deployed, or point to the fact they are not all adopted immediately to imply that only better delivery rather than new technology is what we need. We need both. When added together they produce a sufficiently better solution which will often have a sudden and unexpected impact across a wide area.

One example is the emergence over a relatively short period in the 1980s and 90s of the zero-tillage cultivation system by small-scale farmers in the Indo-Gangetic Plains which covers parts of India, Nepal, Pakistan, and Bangladesh. Grain seeds are planted into unploughed fields in order to conserve soil fertility, economise on scarce water, reduce land degradation, and lower production costs. Many diverse individual pieces of research involving numerous scientific disciplines, including appropriate locally made planting equipment, were needed to make the system practicable and profitable; no one was taken up on its own. The combined package was however highly attractive to farmers and over 600,000 farmers now use varying forms of conservation agriculture on an estimated 1.76 million hectares of wheat, with average income gains amounting to US$180–340 per household.

Climate change provides an equally complex set of problems. Overall the impact of climate change on food security and poverty is likely to be profoundly negative, but this does not

mean it will be universally bad for food security in all areas of the world and implying it is is generally poor advocacy (as it is clearly not true) and likely to lead to simplistic policy decisions. Certain impacts are almost invariably harmful such as the acidification of the oceans and other water as a result of rising CO2, or increased salinity of soil due to water stress.

On the other hand rising CO2 directly may in some cases be good for crop yields, which after all use CO2, at least where C3 based plants such as wheat or barley predominate. Unfortunately C4 based plants constitute the majority of plants able to tolerate very dry environments, as well as many of the tropical staples such as maize or sorgum and C4 based plants are not likely to benefit from increased CO2- one of many reasons tropical areas are likely to suffer disproportionately the disadvantages of climate change.

The most important part of climate change for agriculture, although one of the most difficult to model, is changes in rainfall which in the longer term may benefit some areas and will undoubtedly disadvantage others. Unfortunately, existing agriculture practices in any given area are designed for rainfall patterns which exist at the moment and change, even if from one steady state to another will undoubtedly be painful in some places and catastrophic in others particularly for the poorest who have least ability to adapt. It remains uncertain whether extreme weather events, another potentially devastating environmental impact on farmers, will increase, and if so where.

To minimise the impact of the climate change on food security is going to require both a behavioural and a technological response in affected countries. The technological response is in a sense easier to plan even before we know what changes are likely in particular areas. Within each of the regions where different staples such as maize, rice, wheat and tubers are grown there will be areas that get dryer, areas that get wetter, and some areas where salinity will increase at the same time as CO2 and temperatures rise. Developing varieties of key plants which will minimise the reduction in productivity in these changed circumstances will be essential whatever happens in any particular sub-region.

Planning adaptation is a more complex task because it does require us to know what is going to change and where. Currently our understanding of climate change science is relatively crude, especially as it affects Africa. We cannot predict which regional areas and therefore which societies will be affected in particular ways with the degree of certainty needed to make a coherent policy response. Since steps to make adaptation easier have to start from the basis of existing cultural, environmental and acgricultural practice this makes designing potential responses in advance of changes occurring very difficult, because we don't know which change will occur where. An adaptation of farming practices to drier weather developed in Uganda may be of little or no use in Sudan, even if Sudan is subsequently the place where rainfall decreases, because cultural and agricultural practices are different. This is made more complex again by the fact that society is not static but is changing rapidly, not always in a bad way. The rates of GDP growth in many parts of Africa, whilst far slower than China or other parts of Asia, is still ahead of much of the northern world. This is mirroring a steady increase in agricultural productivity although not one fast enough for the probable growth in population.

One final layer of complexity which your conference is not explicitly concentrating on but which is something CABI has historically made a huge difference in is infectious diseases. Both in animal and plant health infectious diseases have the capacity unpredictably and dramatically to destroy whole industries and where they affect staple foods to change history. For example potato blight changed the history of Ireland forever. Other plant and livestock diseases have had equally dramatic impact on development, and continue to do so. Taken cumulatively, the potential of disease to disrupt vulnerable livelihoods and reduce the positive impact that agriculture can have on poverty and food security remains vast. It is no coincidence that the green revolution was sparked by the work of the late Norman Borlaug, on developing wheat varieties resistant to stem rust. Ironically in the year of his death the emergence of new virulent strains of rust is once again threatening global food security, and indeed security more widely, including some very vulnerable areas- for example Ug99 in Iran is already a major economic problem, even if it does not spread to areas in Afghanistan we

are trying to replace one cashcrop, opium poppies, with another, wheat. Addressing these problems requires a new global partnership, encompassing both the public research organisations, the CGIAR, regional research bodies and developed and developing countries national research organisations.

China and other emerging economies with rapidly developing technical and scientific skills have a huge role to play in this effort. But also so do the major private sector organisations where so much of the global expertise and investment now resides. It requires also that we use all the techniques and approaches at our disposal and move away from sterile debates about which technology is most appropriate; theological rather than scientific debates about the place of GM technology are one example.

Addressing these problems will require a scaled up effort to get new technology, ways of doing things and knowledge to farmers globally. It will also require a global monitoring and surveillance effort. In each of these areas CABI has a vital role to play.

The days in which agriculture is seen as a marginal sector; separated from global development debates have gone, at least for the foreseeable future. Certainly in the UK the recent government White Paper from DFID put in concrete terms many of the key problems and some of the UK's responses, ranging from increased investment into agriculture to better modelling of rainfall in Africq. We must seize this opportunity to ensure that policymakers, who are making serious attempts to address food security, are given what they need to understand how the many challenges for food security you will be discussing in this conference interlink.

There are three possible responses to the fact that the policy challenges we face are very complex, made up of many steps and interlock. The first is to say 'its just too difficult' and give up in despair. The second is to say 'well, lets just concentrate on a few big problems we can take a serious swing at'. The third is to recognise that with the difficulties of handling many complexities come real opportunities. Rather than one big idea we can respond with multiple small steps, which can be combined in many different ways for different situations. This actually makes it far more likely we can respond both to change we know will happen and to the unexpected. Its like the difference between investing in a diversified portfolio and putting all your money on a national lottery ticket. One is spectacular- but unlikely to succeed. The other is undramatic, but year on year both can and probably will lead to major change. Complex responses are, if well designed, flexible responses.

If we do not make a clear and compelling case for taking the complexities into account and discussing them openly we cannot be surprised if well-meaning people pushing a single, simple but sometimes unrealistic message capture the agenda. This conference has a major part to play in this process, and even more importantly in pushing forward the scientific debates in all the areas i have touched on and several, which in the interests of you getting your dinner I have not. The work of CABI and many other organisations you have brought together here allow us simultaneously to help farmers access appropriate technology we know works now,, developing new technologies which will improve our potential to improve food security in the medium term and reducing the threats which future change, both predictable and unpredictable will bring in the longer term. DFID admires this work, and intends to continue to support it.