International and National Agricultural Research Frontiers

Peter Core

Paper prepared for presentation at the "Agriculture In A Changing Climate: The New International Research Frontier" conference conducted by the Crawford Fund for International Agricultural Research, Parliament House, Canberra, Australia, 3 September 2008

International and National Agricultural Research Frontiers

PETER CORE

ACIAR
GPO Box 1571
Canberra ACT 2601

Let me begin by saying that Professor Ross Garnaut was right when, at the National Press Club on 4 July 2008, he said:

> Climate change is a diabolical policy problem. It is harder than any other issue of high importance that has come before our polity in living memory. Climate change presents a new kind of challenge. It is uncertain in its form and extent rather than drawn in clear lines. It is insidious rather than directly confrontational. It is long-term rather than immediate in both its impacts and its remedies. Any effective remedies lie beyond any act of national will, requiring international cooperation of unprecedented dimension and complexity.

It is true that there is substantial uncertainty about the nature of the relationships between higher atmospheric carbon concentrations (Fig. 1) and changes in global temperature and rainfall and its distribution. This uncertainty, in part, is causing debate about substantive issues of the appropriate global response and the burdens of how this response will be shared. Taken together — the uncertainties and burden sharing — it is clear that we are facing a diabolical political problem where time is running out for us to slow down and stabilise atmospheric carbon levels. But start we must.

My job here is to focus on the agricultural research response. Another way of thinking about this question is to ask how you would tackle allocating 100 units of research funding to agricultural research that focussed on a changing climate. Such an allocation might leave some of us uneasy, but the reality is that research funding

PETER CORE is the Chief Executive Officer of the Australian Centre for International Agricultural Research, a position he has held since July 2002. He has a long history in agriculture, initially with the OECD Agricultural Directorate in Paris and then with the Department of Primary Industries and Energy, rising to the position of Deputy Secretary in 1988 before accepting the CEO position with the Department of Industrial Relations in 1993. He then headed the Department of Transport from January 1995 until March 1996. During that period, he was a director of Airservices Australia and the Federal Airports Corporation. From May 1996 to June 2002, Mr Core was Managing Director of the Rural Industries Research and Development Corporation. He holds a Master of Economics and Bachelor of Rural Science from the University of New England.

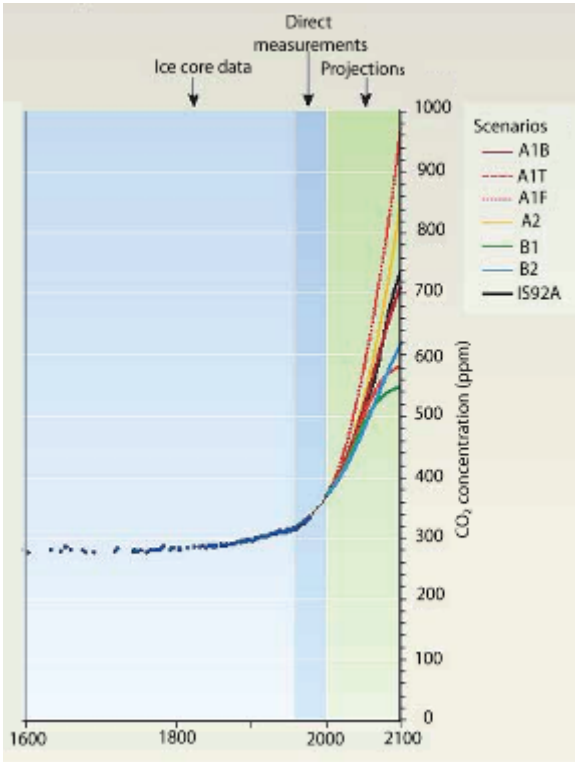

Figure 1. Past and future atmospheric CO_2 concentrations

is always limited and must always be prioritised. Serendipity has its place but, in my view, within relatively broad areas of priority research.

I will address the agricultural research response, but first let me share three key concerns with you that stretch well beyond agriculture.

The **first** is that I think it is unrealistic for the OECD — the rich countries — to expect that countries with GDP per capita of less than $2000 per annum will make the tough adjustments expected by countries with the standard of living of countries such as Australia. This problem has arisen from industrialisation fuelled by hydrocarbons, and it is the OECD countries that historically, and on a per-capita basis, have been the emitters.

My **second** concern is that the consequences for agriculture far outweigh its contribution to the problem. And, it follows from that, that the solutions to the problem rest much closer to those that are causing the problem.

That is not to say that agriculture does not have a role to play in mitigation. It does, but in my view any realistic response to climate change will rest with changing the energy mix away from hydrocarbons and reducing our own energy-intensive lifestyles.

My **third** concern is that I am fairly pessimistic about our collective willingness to reduce our energy consumption levels without significantly higher hydrocarbon prices. It is almost as if there is a 'disconnect' between the growing recognition of the problem and our own behaviour. It is as though this is one of those problems that someone else must do something about.

Broader research priorities — economy-wide

It follows from this that our primary research challenge as a people is to implement a much bigger effort in research, development and commercialisation of lower-emissions technologies. In reality, this investment is only just getting started in terms of the scale that is required. Global consortia will be required and, in my view, the outputs from these consortia need to have the status of international public goods — outputs that are not fettered by intellectual property rights.

We have heard much in Australia and elsewhere about emission trading schemes. These 'cap-and-trade' policies are an essential prerequisite to any climate policy response. Their purpose is to price carbon and provide the economic incentives for lower-emission technologies. A significant research agenda in terms of the public policies is required to underpin efficient energy markets. This research will be ongoing because the reality is that we are really talking about a relatively significant transformation across important components of the Australian economy.

Agriculture – climate – research

Earlier contributors have provided wonderful presentations on climate change as it relates to forests, crops, livestock, fisheries, pests and crop diversity. All these are key research issues and worthy of special focus.

But in my mind, being supportive of all does not necessarily help in resource allocation decisions. Remember my earlier question: how would you allocate 100 units of research funding to agricultural research that focussed on a changing climate?

Looking across the legitimate research priorities, my emphasis in approaching resource allocation would be as follows:

Climate-adaptive crops

Another way of expressing this area of work is stress-tolerant crop cultivars. In the future we will need crop varieties with greater tolerance to drought and heat. At the Consultative Group on International Agricultural Research (CGIAR) centres, scientists have worked and continue to work on developing hardier varieties. There are several important recent examples where the latest in molecular biology is being combined with farmer participation trials to give results that are truly relevant to local needs and preferences.

At the International Maize and Wheat Improvement Center (CIMMYT), scientists have been prioritising major stresses to **maize** — drought, low soil fertility, insect pests and soils — and replicating them on breeding stations. Previously, selections were done under well-fertilised, well-irrigated conditions. In Southern Africa alone, enough seed of new, stress-tolerant maize cultivars has been produced to sow two million hectares.

Similar gains are being obtained with **wheat** by CIMMYT scientists working with national partners. Experimental cultivars derived from crosses between wheat and goat grass, one of wheat's wild relatives, have produced up to 30% more grain than their wheat parents, in tests over two years under tough dryland conditions.

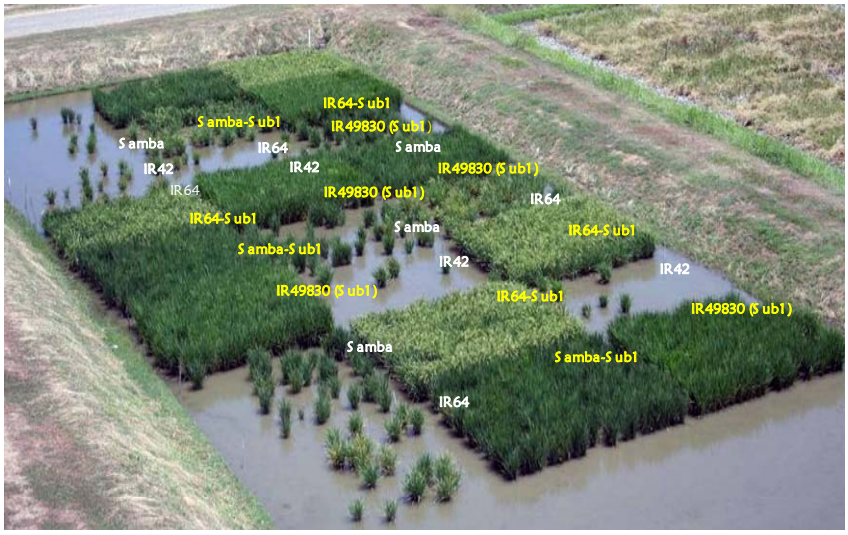

Figure 2. New Sub1 lines after 17 days submergence in the field at IRRI

One of the more exciting advances in crop improvement in recent times has been the development of **new rices** for Africa — the NERICA varieties. These varieties combine the high productivity of Asian rice with the ability of African rice to tolerate harsher growing conditions.

And here in Asia scientists at the International Rice Research Institute (IRRI) have found a genetic remedy for the risk of flooding in rice crops (Fig. 2). Rice is the only cereal crop that can withstand any degree of submergence, but most varieties die if fully submerged for more than three days. Now, IRRI researchers and collaborators have identified a rice gene which allows plants to survive completely submerged for up to two weeks. The 'waterproofing' trait has been transferred into a rice variety popular in Bangladesh and the improved version is giving high yields while protecting harvests against flooding.

I raise these as recent examples of the work being done on tolerance to drought, flooding and heat, and combining it with other valuable traits such as better nutritional quality. But the reality is that this work is being done on a shoestring. There has been a global complacency and there is an urgent need to double and redouble our efforts in developing climate-resilient crops.

But most importantly it does not stop with the breeders. All of their work needs to be done with national partners and ground truthed with site-specific trials. This is why the partnership between CGIAR centres and national agencies is so important. And moisture-conserving technologies such as reducing tillage and direct seeding of rice will be crucial in climate change adaptation.

Enhancing water productivity

Let me move to water. It is clear to all that climate change is putting pressure on water availability. This would be my second key research priority after seeking to develop stronger stress-tolerant crop cultivars. A lot of this work is site-specific and there are numerous examples of important work being done by CGIAR centres on dry irrigation and improved water-harvesting technologies. This work is vital but, in my view, even more important is the work on the public policy framework because a significant element of the water issue is a 'tragedy of the commons' — whether it be above ground or below. Both the International Food Policy Research Institute (IFPRI) and the International Water Management Institute (IWMI) are DOIng important work in this area, but much more needs to be done.

Let me divert for one second. When we talk about water, I suspect many of us here today think about how we should lower extraction rates and return more to the environment.

I am probably the odd one out, again, but I think better water storage is part of the solution in Africa. Take the case of Ethiopia, which is typical of many sub-Saharan African countries in terms of water resources and management. Its water storage capacity is less than 40 cubic meters per person, compared to almost 5000 cubic meters per person for Australia, an amount that may prove inadequate in the face of expected climate change impacts.

Africa will need new large- and medium-sized dams to deal with its critical lack of water storage capacity. But other, simpler solutions must be part

of the equation as well, such as construction of small reservoirs, sustainable use of groundwater systems (inducing artificial groundwater recharge) and rainwater harvesting for small vegetable gardens.

My point is that as important global institutions move back into significant infrastructure investments, underpinning research will be vital to maximising the benefits of these investments to the community of farmers in low income countries.

Slowing deforestation

Deforestation through burning accounts for at least 20% of global carbon emissions. This is a key public policy issue and there are several research angles that need to be worked on. Monitoring clearly needs to be upgraded to foster transparency, but, much more than that, developing country partners need to be compensated for their carbon storage and this compensation needs to benefit those that are dependant on the forests. The Center for International Forestry Research (CIFOR), the CGIAR forestry centre, has a very important role to play in our region and, just recently, the Australian Government announced an International Forest Carbon Initiative. Activities under this initiative have provided $3 million to CIFOR to further the research on policy and technical issues associated with reducing emissions from deforestation. And ACIAR has its own $1.5 million project with the Australian National University, CIFOR and Indonesian partners on better governance arrangements to reduce emissions from deforestation.

There is a broader agenda

The impact of climate change on agriculture here in Australia and in the region is a diabolical problem. We have been too sanguine about our ability to feed the world. Over the past ten years we have stood by while productivity gains of our basic staples — rice, wheat, maize, cassava — have stagnated (Fig. 3). It is clear that the productivity gains of these key crops need to double — and get back to the results achieved in the 1980s and early 1990s, but we have to do it in an era of climate change.

We have diverted resources into areas with little scope for broad-based, high impact in the key producing areas. Policies that subsidise the conversion of grain into transport fuel are a real problem. Climate change is making our job that much harder. Nearly all the evidence points to this as the new reality. But I don't despair. Research partnerships are not an exclusive panacea but they are a very essential ingredient. We need to redouble our efforts and stay focussed over the longer term — something we are not good at here in Australia. In my view I would focus our joint efforts around:

- building stress-tolerant crop cultivars of the basic staples and conducting site-specific trials of these cultivars in the key production areas
- enhancing water productivity
- slowing the rate of deforestation.

And, if pushed, I would allocate my 100 units of the research funding with the following weights: 60 units to the breeders, 15 units to water productivity and 25 units to deforestation. And, for what it is worth, I want to reemphasise the crucial importance of research, development and commercialisation of lower-emission technologies. It is in this area that the key emitters should be focusing — for the longer term.

Conclusion

Yesterday I had an opportunity to listen to a presentation entitled 'High Food Prices' by a colleague of mine, Dr Andy Stoeckel. He confronted us with the dimension of the food security problem with a forecast 40% increase in population — an extra 2.4 billion people over the next 50 years and the associated productivity challenge (Figs 4 and 5). My reaction was that if we can manage to get productivity of the basic staples back up over 2% per annum on a consistent basis across the key regions of the world, we are going to be in a substantially better

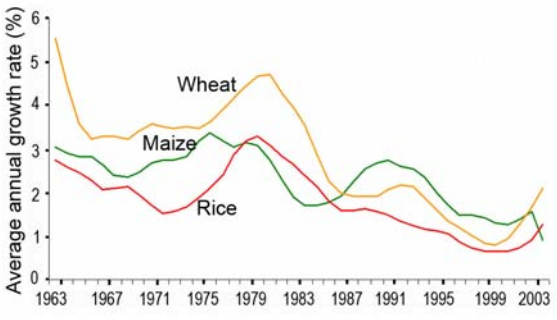

Figure 3. Growth rates of yields for major cereals are slowing for developing countries.
Source: *2008 World Bank, World Development Report: Agriculture for Development.* Washington, 2007

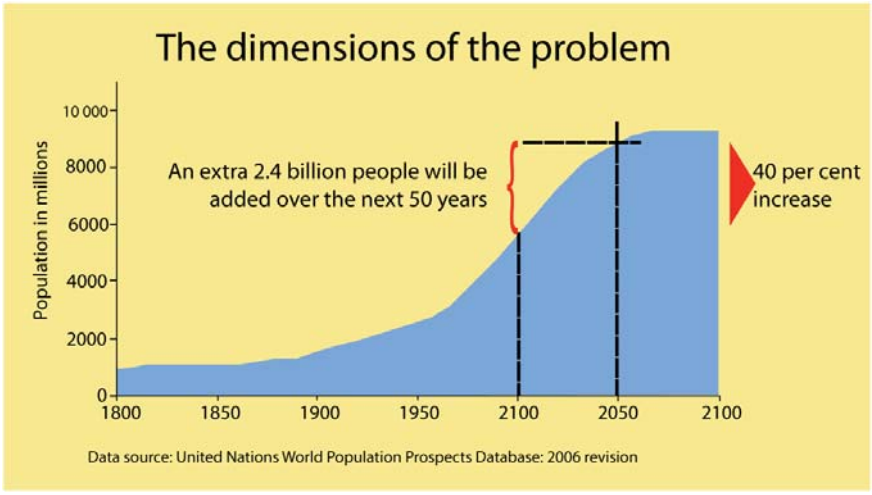

Figure 4. Population projections

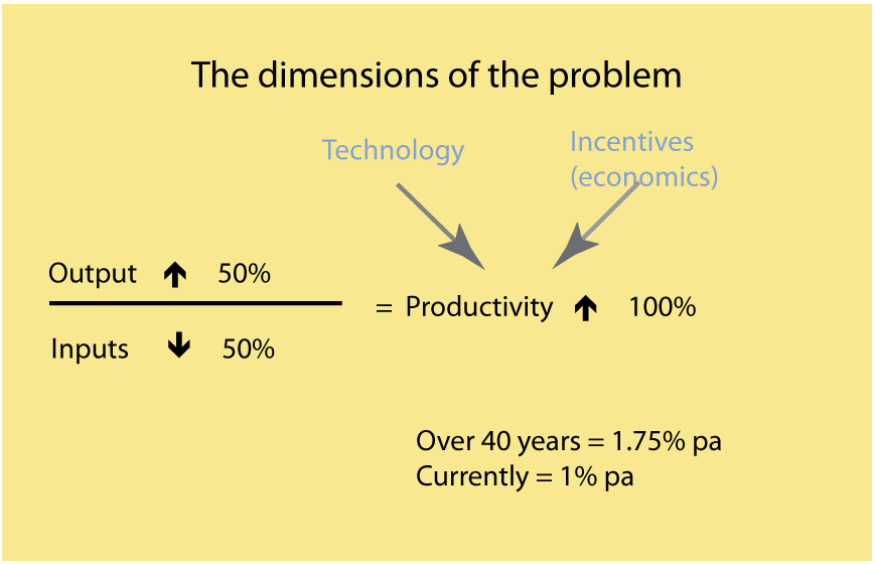

Figure 5. The productivity challenge

position than where we are now. It is going to be more difficult than in the past, but that is our challenge.

There are no guarantees, but I am sure that research investment will have high pay-offs. It has got a track record of high returns. We need to get on with the job.

Those responsible for these research investments need to be held accountable, but today's world is not 'business as usual'. It requires quantum changes and a new long-term focus.

Further reading

Stoeckel, A. (2008) *High Food Prices: Causes, Implications and Solutions*. Rural Industries Research and Development Corporation, Canberra, Australia, 24 pp. Available from: http://www.rirdc.gov.au/reports/GLC/08-100sum.html

Transcript of Professor Ross Garnaut's *National Press Club Address* on the draft report launch 4 July 2008. Available from: http//www.garnautreview.org.au

Von Braun, J. (2007) *The World Food Situation: New Driving Forces and Required Actions.* International Food Policy Research Institute, Washington, USA. Available from: http://www.ifpri.org/pubs/fpr/pr18.asp

Von Braun, J. *et al.* (2008) *High Food Prices: The What, Who and How of Proposed Policy Actions*. International Food Policy Research Institute, Washington, USA. Available from: http://www.ifpri.org/PUBS/ib/foodprices.asp

World Bank (2007) *World Development Report 2008, Agriculture for Development.* World Bank, Washington, USA. Available from: http//www.worldbank.org/wdr2008