KEY POINTS

- ACIAR CEO addresses the agricultural aid strategies that will best serve poor rural communities in the future.
- ‘One size fits all’ strategy loses favour as poverty reduction measures look to country and region-specific solutions, market conditions and biophysical constraints.
- The approach advocates for a series of mini ‘green revolutions’ centred on similar agroecological zones.

SCIENCE and FOOD SECURITY

Kerry O’Keeffe
A series of mini ‘green revolutions’, each targeting specific needs, may be the best way for agricultural research and development (R&D) to meet challenges posed by the confluence of rising populations, climate change, and competition for land and water resources.

Unlike the Green Revolution of the 1960s, when substantial production gains were possible through plant breeding and improved agronomy, we now need to make gains incrementally by tailoring funding, investment, policy and R&D to a wide spread of countries, communities and markets.

There is no longer the same scope for a ‘one size fits all’ approach to global agricultural development. The best approaches to ending poverty are those that understand the issues present within a country or region and design responses accordingly to create the right packages in the right place at the right time.

And the urgency of achieving this is starting to be recognised again by the world community.

The connection between population growth, food security and social security is now well recognised. Today, the world’s population stands at 6.8 billion and rising. By 2050 it will reach nine billion. Of today’s 6.8 billion, more than one billion live in poverty, lacking food security.

The reasons for this lack include a convergence of factors beyond recent food and financial crises: climate change, decreasing funding for agricultural R&D over past decades and a rapidly growing population. These are balanced by the capacity of agricultural science to deliver step-change improvements in cultivation.

Agricultural R&D is our collective insurance against a plateauing of growth in food production must cease at some point. Dire predictions of mass starvation were made during the middle of last century, at least until the Green Revolution. Scientists, led by Norman Borlaug, contributed to a transformation of agriculture that enabled food production to more than keep pace with population growth.

The financial and food crises of 2008, with attendant rises in food prices, have now led many to refocus on the question of feeding the world.

Food security is once again on the international agenda. Some would suggest that feeding nine billion people requires a new Green Revolution, while others are pessimistic about such prospects.

But agricultural science can continue to match food production to population growth. More than that, it can be a catalyst for lifting many of the world’s estimated 1.4 billion poor people from poverty.

Agricultural science has a tremendous track record of success. During the past 50 years, agricultural R&D has been pivotal in lifting gross world food production by 138%, from 1.84 billion tonnes to 4.38 billion tonnes.

Most extraordinarily, that increase has been achieved as international investment in agricultural research has declined over past decades. The value of aid to agriculture has halved since the mid 1980s. The share of aid to agriculture has declined even more sharply, from 17% in the late 1980s to 6% in 2007. Agricultural research represents only a fraction of this amount.

There is an apparent conundrum when you overlay the steep upward trend in agricultural productivity against stagnant or declining research investment. The answer lies in the long lag times, sometimes several decades, between investment and impact.

The global disinvestment in agricultural research is startling when one considers how important agricultural production has been as a driver of growth in the developing world. As Professor Peter Timmer observed, “no country has been able to sustain a rapid transition out of poverty without raising productivity in its agricultural sector”.

Broad-based economic growth in developing countries is achieved by focusing on the largest sector—agriculture. In most developing countries 60–80% of the population are employed in, or reliant for their livelihood on, agriculture.

Achieving productivity gains in this sector lifts incomes, reduces poverty and creates opportunities in other sectors, through freeing up labour and generating growth in communities.

The Green Revolution is perhaps the pinnacle of development catalysed by agricultural research. The matches of new varieties and fertiliser and the cultivation of new land in both rainfed and irrigated environments was a perfect package of innovations, at the right time, in the right place.

While it is easy to overlook the policy drivers, and policy environments that enabled such success, the pivotal role of agricultural research cannot be denied.

Since that time, agricultural R&D has endeavoured to replicate these gains. A focus on land, water and fertiliser, in concert with new higher-yielding varieties, represented the low-hanging fruit. It is little wonder that rates
of return were so high.

The original successes may have legitimised the assumption that agricultural research can continue to produce these gains well into the future. The reality is that future productivity gains will be far harder to secure.

Rates of agricultural productivity growth are slowing, most markedly in the developed world, where rates have dropped from around 3.5% in the 1980s to about 1.5% today.

To put this in context, agricultural productivity growth of around 1.8% is required simply to maintain pace with population growth.

The multi-decadal lags between investment and return are grounds for concern. Although recent renewed interest in food security has slowed—or in some cases reversed—declines in investment, the flow through to productivity growth is some way off.

The Consultative Group on International Agricultural Research, or CGIAR, is the pre-eminent multilateral body in delivering public-good agricultural innovation. It plays an important role in linking these goods to domestic science, and agriculture, in developing countries. CGIAR centres, such as the International Maize and Wheat Improvement Center (CIMMYT) and the International Rice Research Institute (IRRI) played key roles in the successes of the Green Revolution.

The CGIAR is in many ways a microcosm of the broader trends in agricultural R&D.

Funding to the CGIAR centres stalled during the 1990s, with funding previously devoted to productivity-based research increasingly being diverted to environmental and social considerations.

Some of the research focus has also shifted from productivity to maintenance of gains, ensuring disease, pests and weeds do not erode the gains already won.

Emerging problems, such as the black stem rust fungus known as Ug99, and other issues of interest often result in donors tying funding to specific projects, rather than providing untied funding. The increasing push for a clear line of sight on dollars invested has also contributed to the desire of donors to tie funds to specific projects.

More broadly, agricultural funding trends have been impacted by other factors too. Private sector funding has, like donor funding, sought a clear line of sight, though with profits in mind.

Changing investment environments, propelled by IP rights and tax incentives, skewed private sector investment towards some spheres of research, particularly where productivity gains can be leveraged against IP to maximise profits.

Where such opportunities are not as clear, for example in soil science or environmental management, public investment is required to fill the gap.

Recent history suggests that where agriculture is delivering sufficient food, and prices for that food are falling, imperatives for agricultural research investment are easily forgotten.

The reality is that neither public investment alone nor private investment alone can deliver the solutions needed for agriculture. In developing countries particularly, with the range of markets, coupled with sometimes fragile policy environments, flexibility is needed.

This may be disappointing to those seeking a ‘one size fits all’ solution, or to those advocating debt relief as an answer to poverty.

The best approaches to ending poverty are those that truly appreciate the issues present within a country or region and design respond accordingly.

The danger in a single approach to the challenge of ending poverty is implementing solutions that are not the right package in the right place at the right time.

Designing the appropriate response begins with understanding the environment: getting the balance right between public and private investment, utilising research outcomes and domestic policy environments, along with biophysical characteristics and market constraints.

Potential agricultural R&D solutions within developing countries must be designed to interact with the reality of governance and policy environments and market conditions, as well as biophysical constraints.

So a more realistic response may be a series of mini green revolutions, each targeting the specific needs of a country or region. These may be localised to areas within nations, centred on similar agroecological zones. The key characteristic of each mini revolution in agriculture will be
intellectual capital, that is, the knowledge R&D creates, towards the unique dynamics and challenges presented by such environments.

Research will be needed not only into technological solutions but into human and environmental dimensions: value chains, markets, gender, equity, health, nutrition and so on.

Australia has been a world leader in agricultural research for many years. The benefits flowing from this research have applications beyond our shores. Australia shares the range of agricultural environments—and problems—with many areas in Asia, the Pacific and beyond.

ACIAR enhances spillovers between Australian and developing country research by brokering research partnerships across the spectrum of public and private spheres, providing intellectual capital to agricultural researchers in developing countries.

In East Timor, for example, a survey of subsistence farmers by researchers working as part of Australia’s aid program found that no family among those surveyed had sufficient food staples of rice or maize to last a full year. Seven out of 10 families went without maize for 4 or more months each year. All families surveyed were forced to ration food for 1–6 months each year. Many families reported that they gathered wild food regularly, with the worst affected consuming seed needed for planting crops the following season.

Australia is helping to reverse this situation by introducing crop varieties that are better suited to local growing conditions and which yield higher than the varieties currently grown. Working with the centres of the Consultative Group on International Agricultural Research (CGIAR), the Australian aid program, through ACIAR, sourced a number of staple crop varieties suited to the agroecological conditions in East Timor.

Since research began in 2005, 114 of East Timor’s 442 villages have seen improvements in food security as a result of seed dissemination and field trials funded by Australia.

Interviews with farmers participating in the project found that more than half had sold, on average, one-third of their increased crop production and used the extra income to buy rice, protein and other produce to enrich the family diet.

ACIAR’s role in East Timor is small but important. We have designed projects that take public-good assets, in the form of CGIAR-held seed, and delivered these into farming areas in the country, testing varieties to determine the most successful.

At the same time we are helping rebuild the research capacity of both government and academic sectors, engaging with the public sector in East Timor to ensure it has the infrastructure and capacity to deliver on publicly funded R&D in the future.

Of course this is different to much of the research undertaken in China, for example, where recent work relates to WTO accession and equalising the flow of benefits from trade across the country. This reflects the differences between the agricultural and policy environments in the two countries.

Were ACIAR to reverse these approaches taken in East Timor and China, neither program would have much success.

The steps to the next series of mini green revolutions—be they in Asia, Africa or elsewhere—will begin with targeted approaches to the unique needs of individual countries and localities. Investment in agricultural research will inform, and should flow from, that understanding.

Agricultural R&D can be a powerful driver of development and provider of food security. Ensuring R&D continues to deliver on this promise begins with an understanding that the way ahead is not the broad avenue travelled by the Green Revolution, but rather a series of winding pathways, each with its own challenges and unique solutions.

Returns on investment in agricultural R&D

Investment in agricultural research is characterised by consistently high returns. Alston et al. (2000) compiled 289 studies of returns to agricultural research and development and, based on the resulting 1,821 estimates of rates of return, calculated the overall average annual rates of return to be 65%. Based on these high returns, the authors concluded that there has been significant underinvestment in agricultural research.

According to the World Development Report 2008, investment in agriculture research has “paid off handsomely”, delivering an average internal rate of return of 43% in 700 development projects evaluated in developing countries.

In an analysis of Australian case studies, Mullen (2007) concluded that returns to agricultural research have been between 15 and 40%. Importantly, Mullen (2007) found no evidence of a decline in rates of return to agricultural investment over time, supporting Alston et al.’s observations about underinvestment.

Recently Harding et al. (2009) undertook a meta-analysis of 37 quantitative impact assessments of Australian Government investment in international agricultural research. They too identified high returns (average benefit:cost ratio of 54) and found evidence that returns have been increasing over time.

Alston (2002) highlighted the profound implications of spillovers from public agricultural R&D and proposed that half of productivity gains in a state or nation may arise from research conducted elsewhere. Spillovers also have major implications for the manner in which research benefits are distributed between countries, as well as between producers and consumers.

Research generates benefits that flow regionally, nationally and internationally. The inability of a party to capture or control the flow of benefits for themselves—or ‘spillovers’ (the extent to which one party benefits from the stock of R&D of another party)—leads to underinvestment by the private sector. In developed countries institutional mechanisms, such as intellectual property (IP) rights, tax incentives and government-industry research collaboration, such as cooperative research centres, are employed to address this private sector underinvestment. Recent analyses call into question the extent to which private sector investment has grown under these mechanisms (Pardey pers commun.). However, the legal and institutional frameworks in developing countries are such that public investment will remain essential for the foreseeable future.

REFERENCES


