CGIAR Science Forum 2009

Science for Development: Mobilizing Global Linkages

INDEPENDENT SCIENCE & PARTNERSHIP COUNCIL
CGIAR

In its current exciting phase of transition and development, the CGIAR is more than ever committed to building stronger and more strategic partnerships in order to strengthen the impact of its work. As a contribution to this, the Science Council (which now, in recognition of this imperative has become the Independent Science and Partnership Council) convened Science Forum 2009 in partnership with the CGIAR Secretariat, the Alliance of the CGIAR Centres, the Global Forum on Agricultural Research (GFAR) and Wageningen University and Research Centre. All CGIAR Centers and Challenge Programs were represented.

Science Forum 2009 brought together more than 300 scientists, donors and civil society groups from 55 countries to examine a range of scientific advances and to discuss arrangements that can help to mobilize them more effectively for development.

The Forum chose six fields which have opportunities to contribute to agriculture and the future supply of food and debated which new areas of research hold the greatest promise to accelerate progress on development goals, where the most immediate research needs are, and which kinds of partnerships should be encouraged to bring this to fruition.

Science Forum 2009 represents a positive step towards broader engagement of the international scientific and development communities in research that can help improve agriculture and natural resource management in the developing world.

The publication of a selection of peer-reviewed papers from Science Forum 2009 in a special issue of the journal Crop Science[1] is intended to disseminate even more widely the key messages that emerged from the Forum, and to highlight potential areas of partnership in research for development.

The Forum's conclusions and directions are offered as a contribution to the ongoing process of developing the new research agenda of the CGIAR, and those discussions held under the auspices of the 2010 Global Conference on Agricultural Research for Development (GCARD), as well as providing an input to dialogues in other fora on research for development.

[1] Available at: http://crop.scijournals.org/content/vol50/Supplement_1

CGIAR Science Forum 2009: Points for consideration in the design of future research agendas

There was general agreement that the challenges to food security are broad and, similarly, the search for solutions must be cast widely; no technologies or areas of research should be excluded from consideration for inclusion in research agendas, but rather each should be weighed on their individual merits to contribute to sustainable solutions. Science Forum 2009 covered six broad domains[2] where opportunities exist to contribute to food security, improve nutrition and help to better manage natural resources. Background papers, circulated in advance, focussed attention on the key issues and the potential within each domain (available as part of the special issue of Crop Science). Some points for consideration that emerged from discussions during Science Forum 2009 are presented here.

An approach to *resilience*; frequently the plans and strategies of individual CGIAR Centers and Challenge Programs claim that their research will enhance the 'resilience' of production systems. However, in almost all cases these claims are not supported by clear research hypotheses. It is not clear whether resilience will be enhanced through the way research products are packaged, combined or delivered, or whether scientists believe that they can develop new technologies or management approaches that will lead to greater resilience. The vision statement proposed by the CGIAR in its draft strategic results framework refers to 'resilient ecosystems'. Resilience is determined at least as much by institutions, social learning and other socioeconomic factors as by the biophysical attributes of systems. Discussions at Science Forum 2009 concluded with a preference for the terms 'resilient social–ecological systems' or 'human–environmental systems'. Clearly there is little advantage in perpetuating the "resilience" of degraded systems. In principle, considerations of resilience – and also of transformation, a more necessary objective in some settings – should be mainstreamed throughout the CGIAR's research and should not be singled out as a separate research endeavour. However, given the significance of the issues involved there was support for the idea of a MegaProgram or a component dealing with the goal of 'understanding the management of complex, adaptive human–environment systems', perhaps termed 'the science of human–environment systems'.

Evaluating the impact of adopting a resilience approach involves assessing the counterfactual – the consequences of not making the resilience intervention. Classic CGIAR ex-post assessment of changes in a small number of variables is less suited to this than learning that is embedded in the research process. Large-scale action research in target landscapes and settings is required. Criteria for measuring transformation and transformability are also needed. It is much easier to address issues of resilience and transformation in programs defined around 'place' rather than commodities, Center mandates or disciplines. The logic underlying earlier CGIAR attempts to work on farming systems, eco-regions, cropping systems etc. was thought to have been valid. However, these integrated approaches have met with mixed success. The CGIAR's strategic framework should revisit some of these concepts in its consideration of the organizing logic for the MegaPrograms.

The need to increase efficiency in the use of resources in agricultural production was raised in discussion throughout the Forum. Production ecological principles are based on the notion that a production factor is most efficiently used when other required factors are at their optimum. Inputs should therefore be balanced to crops' needs in time and space, considering location-specific ecological conditions, in order to yield the highest returns on those inputs. These principles have immediate relevance to improving agriculture in developing countries. The concept of eco-efficiency - 'doing more with less'- is a multi-dimensional one, encompassing both ecological and economic dimensions of sustainable agriculture. Although social and institutional aspects of sustainability are often not explicitly captured in eco-efficiency measures, they present significant obstacles, as well as presenting opportunities when trying to

[2] Resilient natural resource systems; The future of food: developing more nutritious diets and safer food; ICTs transforming agricultural science, research and technology generation; Beyond the yield curve: exerting the power of genetics, genomics and synthetic biology; Eco-efficiencies in agro-ecosystems; and Agriculture beyond food: science for a bio-based economy.

transition to more eco-efficient agriculture, and as such they should be taken into account. Risk remains a critical factor influencing the uptake of more eco-efficient measures. To achieve greater eco-efficiencies and increase sustainable food production in the developing world, those risks most relevant in the context of developing country agriculture must be taken into consideration in research programs. Further investment is needed not just in genebanks, but in soil, water and nutrient 'banks' as a means to dampen yield variability and risk.

Increasing crop yields requires a combination of improved genotypes and optimal management, including the timely availability of appropriate inputs. Genetic improvement research therefore needs to advance hand in hand with better understanding of physiology and the phenotypic responses of plants in specific agronomic, climate and input market settings. For greater impact, programs should be designed around this interactive framework and not viewed in disciplinary isolation.

There is considerable opportunity to improve plant genotypes. Emerging opportunities can combine the analytical power of molecular biology in trait identification and capture, with traditional breeding, to shorten the time-frame of research. New technologies include whole genome selection (WGS) for analysing complex traits with reduced phenotyping costs, gene knockout for identifying gene function, and marker assisted recurrent selection (MARS) for pyramiding elite genes. With the help of molecular technologies, plant breeding can continue to contribute significantly to the achievement of yield increases in the coming decades. The CGIAR should continue to strengthen its partnerships with other institutions in this area. The cost of molecular biology has declined and speed has increased, greatly enhancing its potential contribution to research in such applications as genome sequencing, genetic diversity maps, gene function and trait identification. This enables the CGIAR to move ahead with its agenda more swiftly, especially through partnerships and outsourcing, and to increase the power of analysis in broader comparative approaches (across related species of cereals, for instance). The success of breeding programs, both conventional and advanced, relies on the diversity of the germplasm available. There is a continuing need to maintain and characterise the biodiversity of wild relatives of key species. Support for the role of the CGIAR and other genebanks should be integrated into the design of MegaPrograms.

In the context of genotype - environment interactions, one serious consequence of climate change will be the increased variability and uncertainty it brings. The uncertainty inherent in climate scenarios is often overlooked by decision-makers. It is important to incorporate climate risk management into breeding programs (both traditional and advanced), to develop crops that will be better adapted to future conditions.

An important understanding derived from the Forum was not only regarding technology, but was focussed on how we will implement new science, and research for development overall. In the adoption of integrated approaches, there will be a continuing need for support for capacity building, not only in genetics and genomics, but also researchers in different fields will need to 'speak each others' language', gaining sufficient understanding of each others' fields to facilitate essential collaborative work. The need to attract people with T-shaped skills (specialists in one area, with a broad general knowledge of related areas) has previously been recognised. The dearth of these kinds of skill sets is one barrier to effective collaborative work across disciplines, and MegaPrograms, in their design, can help to address this.

More information on Science Forum 2009 is available on the ISPC website http://www.sciencecouncil.cgiar.org/home/mobilizing-science/en/
and the special issue of Crop Science can be downloaded free of charge at: http://crop.scijournals.org/content/vol50/Supplement_1