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How to feed a hungry world

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Producing enough food for the world's population in 2050 will be easy. But doing it at an acceptable cost to the planet will depend on research into everything from high-tech seeds to low-tech farming practices.

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With the world's population expected to grow from 6.8 billion today to 9.1 billion by 2050, a certain Malthusian alarmism has set in: how will all these extra mouths be fed? The world's population more than doubled from 3 billion between 1961 and 2007, yet agricultural output kept pace — and current projections (see page 546) suggest it will continue to do so. Admittedly, climate change adds a large degree of uncertainty to projections of agricultural output, but that just underlines the importance of monitoring and research to refine those predictions. That aside, in the words of one official at the Food and Agriculture Organization (FAO) of the United Nations, the task of feeding the world's population in 2050 in itself seems “easily possible”.

Easy, that is, if the world brings into play swathes of extra land, spreads still more fertilizers and pesticides, and further depletes already scarce groundwater supplies. But clearing hundreds of millions of hectares of wildlands — most of the land that would be brought into use is in Latin America and Africa — while increasing today's brand of resource-intensive, environmentally destructive agriculture is a poor option. Therein lies the real challenge in the coming decades: how to expand agricultural output massively without increasing by much the amount of land used.

What is needed is a second green revolution — an approach that Britain's Royal Society aptly describes as the “sustainable intensification of global agriculture”. Such a revolution will require a wholesale realignment of priorities in agricultural research. There is an urgent need for new crop varieties that offer higher yields but use less water, fertilizers or other inputs — created, for example, through long-neglected research on modifying roots (see page 552) — and for crops that are more resistant to drought, heat, submersion and pests. Equally crucial is lower-tech research into basics such as crop rotation, mixed farming of animals and plants on smallholder farms, soil management and curbing waste. (Between one-quarter and one-third of the food produced worldwide is lost or spoiled.)

Developing nations could score substantial gains in productivity by making better use of modern technologies and practices. But that requires money: the FAO estimates that to meet the 2050 challenge, investment throughout the agricultural chain in the developing world must double to US$83 billion a year. Most of that money needs to go towards improving agricultural infrastructure, from production to storage and processing. In Africa, the lack of roads also hampers agricultural productivity, making it expensive and difficult for farmers to get synthetic fertilizers. And research agendas need to be focused on the needs of the poorest and most resource-limited countries, where the majority of the world's population lives and where population growth over the next decades will be greatest. Above all, reinventing farming requires a multidisciplinary approach that involves not just biologists, agronomists and farmers, but also ecologists, policy-makers and social scientists.

To their credit, the world's agricultural scientists are embracing such a broad view. In March, for example, they came

together at the first Global Conference on Agricultural Research for Development in Montpellier, France, to begin working out how to realign research agendas to help meet the needs of farmers in poorer nations. But these plans will not bear fruit unless they get considerably more support from policy-makers and funders.

The growth in public agricultural-research spending peaked in the 1970s and has been withering ever since. Today it is largely flat in rich nations and is actually decreasing in some countries in sub-Saharan Africa, where food needs are among the greatest. The big exceptions are China, where spending has been exponential over the past decade, and, to a lesser extent, India and Brazil. These three countries seem set to become the key suppliers of relevant science and technology to poorer countries. But rich countries have a responsibility too, and calls by scientists for large increases in public spending on agricultural research that is more directly relevant to the developing world are more than justified.

The private sector also has an important part to play. In the past, agribiotechnology companies have focused mostly on the lucrative agriculture markets in rich countries, where private-sector research accounts for more than half of all agricultural research. Recently, however, they have begun to engage in public–private partnerships to generate crops that meet the needs of poorer countries. This move mirrors the emergence more than a decade ago of public partnerships with drug companies to tackle a similar market failure: the development of drugs and vaccines for neglected diseases. As such, it is welcome, and should be greatly expanded (see page 548).

Genetically modified (GM) crops are an important part of the sustainable agriculture toolkit, alongside traditional breeding techniques. But they are not a panacea for world hunger, despite many assertions to the contrary by their proponents. In practice, the first generation of GM crops has been largely irrelevant to poor countries. Overstating these benefits can only increase public distrust of GM organisms, as it plays to concerns about the perceived privatization and monopolization of agriculture, and a focus on profits.

Nor are science and technology by themselves a panacea for world hunger. Poverty, not lack of food production, is the root cause. The world currently has more than enough food, but some 1 billion people still go hungry because they cannot afford to pay for it. The 2008 food crisis, which pushed around 100 million people into hunger, was not so much a result of a food shortage as of a market volatility — with causes going far beyond supply and demand — that sent prices through the roof and sparked riots in several countries. Economics can hit food supply in other ways. The countries in the Organisation for Economic Co-operation and Development pay subsidies to their farmers that total some US$1 billion a day. This makes it very difficult for farmers in developing nations to gain a foothold in world markets.

Nonetheless, research can have a decisive impact by enabling sustainable and productive agriculture — a proven recipe (as is treating neglected diseases) for creating a virtuous circle that lifts communities out of poverty.

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